

THE  
THIRD PART  
OF THE  
PRINCIPLES of the Art MILITARIE  
*practised in the warres of the*  
UNITED PROVINCES,  
*under the*  
LORDS the STATES GENERALL,  
*and his*  
HIGHNESSE the PRINCE of ORANGE,

*Treating*  
Of Severall PEECES of ORDNANCE, CARRIA-  
GES, ENGINES, QUADRANTS, MORTERS, PETARDS,  
as also INSTRUCTIONS for MASTER GVNTERS, and CANONIERS,  
with diverse INSTRUMENTS, and MATERIALS belonging to a warre  
with their severall vses, and practises most briefly, and lively demon-  
strated by letter and FIGURE.

Together with a List of all necessarie preparations,  
appertayning to an ARMIE, with a quarter for the GENERALL  
of the ORDNANCE, and of all OFFICERS belonging to his TRAIENE.

*Written and Composd by* CAPTAINE HENRY  
HEXHAM, *Quarter-Master to the truly honorable Colonell*  
GORING *his REGIMENT, for the Lovers of the*  
*Noble Art Militaris.*



*Printed at the Hagb in Holland,*  
By FRANCIS *vander* SPRUYT, *dwelling*  
*in the Poote.* ANNO 1640.

THE  
THIRD PART  
OF  
PRINCIPLES of the Art-MILITARY  
UNIVERSITY  
OF THE  
LORDS of the STATES GENERAL  
OF THE  
NINETEENTH CENTURY

[illegible]

Topical with a list of all necessary publications.

W. H. & C. Co., Ltd.  
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HIS HIGHNESSE

CHARLES LODOWICK,

PRINCE ELECTOVR,

Count Palatine of the Rhene, &amp; Duke of

Bavaria, &amp;c.

SIR,

**A**fter I had travelled through the World in *Speculation*, by translating, and augmenting of *Atlas Majour* in English, dedicated to his most excellent *Majestie* your Uncle, and my dread *Soveraigne*; I could give noe rest vnto my thoughts, till I had vndertaken some thing of my owne profession, which might give light, vnderstanding, & Instruction, vnto some young Gentlemen, Souldiers, and others, who desire to followe the warres, and to studdie this *Art Militarie*, for their princes seruice, and the good of their Countrie. And where could I finde a fitter place, or a better *Subiect* to work vpon, then in these United Provinces, vnder the Commaund of the *Lords the States Generall*, and his *Highnesse the Prince of Orange*, which now in regard of their long warres, maye truely be called a *Nurserie*, and *sedes belli*, for the breeding, and trayning vp of Souldiers, and verely how could I doe better, then to beginn *ad principium*, with the very first *Principles*, and *Rudiments* of the *Art Militarie*, practised in these warres, vnder the Commaund, first of *Prince Maurice of blessed Memorie*, and now vnder the able *Conduct* of that great, and victorious Captaine Generaell of our age, his *Highnesse the Prince of Orange his Brother*. Now besides what experience my longe service hath gayned vnder their Commaund, for the space of fortie yeeres, as an addition there vnto, I have gott Some translations, and extracts out of the best, and *choicest Authours* of our moderne times, who have writ vpon this subject, to give *Lustre* vnto yt, and having before by the assistāce of God, run through the first two parts: I have now also finshed my third part, concerning all *preparations*, and *necessaries* appertayning to an Armie, and so to put an end unto this *Laborious worke*. For in my first part, I promised the Right honorable the *Earle of Holland*, and in my second part my *noble Colonel*, that I would goe through the three whole parts, for the arming of a Souldier, *de Cap en pied*, that is, at all points, which now thanks be to God, I have done, to the end, that such as maye goe into his maiestis seruice, your Highnesse, or any other forraine State, or Princes, maye gaine some experience, and reape some benifit by my labours, which is, and was the *principall* thing I aymed at, For I hope asould as I am, when these

vnhappie differences at home are reconciled, appeased, and Composed, that God, who *leadeth the hearts of all kings in his hand, as the Water of brookes will* so direct his *Majesties* heart for your right, that his *Maties.* will assist your Hignesse, & turne his powerfull armes an other way, and make your Hignesse *Generall* of a brave *British* Armie, for the *reinducating*, of your *injuries*; and the recouerie of your lawfull, and aneient rights, and inheritances against the *Usurpers* thereof.

I will not trouble your Highnesse any longer with a tedious discourse seeing my selfe, & thousands of true hearted *Brittans* besides my selfe, (when soeuer his *Sacred Matie.* and our dread *Soveraigne* shall lay his *Commandes* vpon us) shalbe all willing, to fight in so just a quarrell, for your Hignesse, and laye our liues downe at your feete, and your queene mothers, for the regaining of your Hignesses rights, and Countries.

This third part then of the *Principles of the Art Militaire*, comes in all humilitie, to present it selfe vnto your Highnesses *gracious patronage*, that though it be meane in it selfe, yet it craues to come forth to the view of the World, vnder your *illustrious* name, which if it maye be acceptable vnto your Highnesse, then I shall think my weake endeavours happily sacrificed, and acknowledge my selfe much obliged to your Highnesse, and shall not onely be bound to pray vnto the *Lord of Hosts*, to honour and blesse your proceedings here in this World with happie Success: but also to crowne you, your *royall mother the Queene of Vertues*, and her princely *progenie* with eternall felicitie hereafter, beseeching your Hignesse to beleeeve, that noe creature living shall more heartely fight, nor more willingly dye in your seruice then,

Sr.

Your Highnesses ever most humble,  
obedient, and devoted servant.

HENRIE HEXHAM.

T O  
The right honorable and most noble Lord.  
M O U N T I O Y E  
Earle of Newport, Generall (or Master) of the Ordnance  
of England, &c.

My LORD,

It maye seeme straunge vnto you, that I who am a straunger vnto your Lordship, and one that lives in a forraine Countrie, should presume to dedicate this *Treat* to the honour of your name : But when I consider two things, it maye challeng some excuse for me. The first is, that my noble *Colonell*, who honours & loues your Lordship did advise mee therevnto. The second is, because it treats of that honorable *Charge*, and *Superintendencie*, which properly appertaines vnto a *Generall of the Artillerie* wherewith your Lo: is invested, as also the *Subordinate Officers* vnder your Command. Such as it is, I beseech your Lo: to accept from an ould Souldier; And as in these Countries where I live, I have dedicated it to his highnesse the *Prince Electour*, who hath graciously accepted of it : so it comes in most humble wiseto craue your Lo: favourable *Patronage* to it in my *native Countrie*, which if it please your Lo: to vouchsafe of it, and that it may goe vnder your honorable name and protection, and so come out to the view of the World, with my Lord Marshals warrant, & licence in the *Frontispice* thereof, I shall think my weake labours and endeavours vpon this subject wel employed, with hopes that it maye prooue vsfull and give some instruction to those who are desirous to studie this noble Art, and shall not onely pray vnto the Almighty to preserve your Lo: in health, with much encrease of honour in this World, but also to crowne you with eternall felicitie hereafter resting.

*Your honours devoted servante ever to Command.*

From Delft in Holland this 10<sup>th</sup>.  
of November 1640. *Stilo novo.*

*Henry Hexham.*



AN  
Authentick Coppie of my Lord Marshall his VVarrant  
graunted to Henry Hexham Quartermaster to the Regiment of the  
honorable Colonell Georg Goring, in the service of the States Generall  
of the Vnited Provinces, vnder the Command of his highnesse  
the Prince of Orange their Generall.

**T**homas Earle of Arandell and Surrey, Earle Marshall of England, &c. Whereas Henry Hexham *Quartermaster to the Regiment of Foote vnder Colonell George Goring, in the service of the States Generael of the Vnited Provinces, hath by his great labour, experience, and long observation, collected and since caused to be printed the three parts of the Art Militaire practized in the Warres of the Vnited Provinces, which though of much use, and very necessarie: yet ought not to be exposed to publick saile, without my particular Licence & approbation in persuance of the order of the high Court of Starr-chamber to that effect: all which I having taken into consideration, and being humbly desired by him to graunt my Warrant, not onely for importation of them; but also for exposing them to saile, I haue thought fit for the reasons abovesaid to condescend therevnto, and doe therefore by these charge, & require all persons whatsoeuer whome it maye concerne, quietly to permit, and suffer him the said Henry Hexham by himself, his Factours & Agents, without any their lett, hindrance, or molestation not onely to shipp, & import the said Bookes into this Kingdome; but also be brought to expose, & put them to publick saile, for his best advantage, be paying all such Customes, & other duties, as for such goods hath formerly bene used and accustomed. This Licence being to continew to him, and his Assignes for the space of one whole yeare from the date hereof, of which you are all required to take notice, and to be obedient therevnto, as yee will answere the contrarie.* Given vnder my hand, and seale at Arandell house the 23<sup>th</sup>. of October 1640. And was signed

Arandell & Surrey.

To all Customers, Searchers, Captaines & Masters of Ships, Majours, Baylifs, Masters and Wardens of the Companie of Stationers of London, and all other his Majesties Officers, and loving Subjects, whom it maye, or shall concerne &c.



# An Index,

Of the principle points handled in this treatise.

The first Chapter, of the <i>Leagues, Alligations &amp; Commixtures</i> of Mettalls, wherewith Ordnance are made.	pag. 1.
Of the Mouldes, & founding of Ordnance.	pag. 2.
The Demonstration of eight severall peeces of Ordnance, founded in the States Generall their service.	pag. 3.
The second Chapter is of a Ladle, a Rammer a Sponge and seild carriage for a peece of Ordnance, and the demonstration and terciaring of any peece of Ordnance, and a carriage.	pag. 4.
The third Chapter of a <i>Block</i> , or a long <i>Waggon</i> , and the figures of a peece of Ordnance drawne both with horse and men.	pag. 5.
The rule of <i>Calibre</i> for these 8 peeces of Ordnance.	pag. 8.
The fourth Chapter of a <i>Fearne</i> , or a <i>Ghynne</i> , a <i>Scallet</i> and a <i>Winch</i> , otherwise called the <i>Endlesse screw</i> .	pag. 9.
The fifth Chapter how a peece of Ordnance is to be mounted vpon it carriage.	pag. 12.
The sixth Chapter is observations how a Canonier ought to charge a peece, and of the Gunners service in generall.	pag. 13. 14.
The seventh Chapter how a Canonier ought to Levell his peece, & to amend a bad short.	pag. 15.
A new devise by any Staff or Ruler, how to <i>Levell</i> mount, or imbase a peece out of Mr. Nortons practise of Artillerie.	pag. 16.
The eight Chapter of severall quadrants, a <i>Levell</i> , and other instruments for Ordnance and the vses of them.	pag. 17. 18.
The ninth Chapter, shewing how a Canonier shall shoote <i>Levell</i> by the Mettall of his peece, or by the <i>Levell Axis</i> , otherwise called <i>Point-blanc</i> .	pag. 20. 21. 22.
The first Dialogue betweene a Generall of the Artillerie and a Captayne to know this question whether a <i>Culvering</i> or a <i>Demy-Canon</i> wil carry furtherst.	pag. 24. 25. 26. 27.
The tenth Chapter is of the demonstration of Morters, and the vse of them.	p. 28. 29. 30.
The eleventh Chapter of the compositions, mixtures, & ingredients for the making of great and small <i>Granades</i> .	pag. 31.
The 12 <sup>th</sup> . Chapter of a <i>Petard</i> , the manner of charging of it, and the fasting of it to a Gate or Port.	pag. 32. 33. 34.
A question betweene two <i>Mathematicians</i> for the Battering of a <i>Horne-worke</i> proued by the Rule of <i>Algebra</i> .	pag. 35. 36. 37. 38.
The second Dialogue betweene a Generall of the Ordnance and a Captaine whether it is better to Batter a Curtaine or a <i>Bulwarks</i> .	pag. 39. 40. 41. 42. 43.
The 13 <sup>th</sup> . Chapter how a Canonier ought to governe himself in making a good short.	pag. 44. 45. 46.
The third Dialogue how and in what manner a Generall of the Artillerie ought to plant his Ordnance in aday of Battle.	pag. 47. 48. 49. 50.
The 14 <sup>th</sup> . Chapter of diuerse sorts of Bridges vsed in the service of the States Generall of a <i>Mathematicall Horse-Water-Mil</i> , & a <i>Water-Scoupe</i> , of a <i>Copper-Oven</i> , a <i>kneading-Trough</i> a <i>Bread</i> , or <i>Byscuit-Chest</i> , & of diuerse sorts of <i>Materials</i> vsed in the <i>Warres</i> .	pag. 51. 52. 53. 54.
Finally, the Office, and charge of the <i>Generall</i> and <i>Master</i> of the Ordnance, and all Officers vnder his traine, with a list, & supposition of what sorts of Ordnance, Munition, Materials, and other necessarie, & preparations, are vsefull to be carryed into te field with an Armie.	pag. 55. 56. 57. 58.
The Demonstration of a <i>Modell</i> and figure of a quarter for the <i>Generall</i> of the Ordnance with all subordinate Officers, marching vnder his Traine,	pag. 59. 60.



# BRIEFE TREATISE

of eight severall peeces of Ordnance, as they are founded vnder the  
Command of the Lords the States Generall of the United Provinces, with their  
appurtenances, carriages, Engines, together with Morters and Tetards, quadrants, and  
Instruction for Master Gunners, and Canoniers with diverse other Instruments & materials  
belonging to the Warres, With their severall uses, and practizes demonstrated.

## The first Chapter.

Treating of the Leagues, Alligations, and Commixture of mettals, wherewith  
Ordnance are Cast, and made in these Countries, and else where.

**T**He *Alloye* wherewith our Ordnance is made here in these  
Countries, is commonly old cast *brasse* peeces, ill proportioned; burst, or made vnserui-  
ceable with too much Shooting, and therefore must be refounded into some better, and  
more seruiceable *formes*, or are such perhaps, as are too great for ordinarie Carriages and  
bullets. If these old *brasse* peeces be of too fine a *mettall* (wich yet is seldome found) the  
Mr. Founder maye mingle some slighter copper amongst it; yea so much as he in his iudgment shall thinke  
fitting: so that the Ordnance, which he makes be answerable to their proofe.

Our newve Ordnance then being founded with these new *alligations*; and *alloyes* are commixed with  $\frac{2}{3}$   
parts of red Copper; made vp in *Sowes*  $\frac{1}{4}$  part of Bell mettall cast also in *Sowes*, and  $\frac{1}{3}$  part of the finest  
Cornish tinne you can gett.

These bricks are peeces of red copper weighing, about 50 lb. weight, cast after the fashion of a  
square footed pauement; and your great *Sowes*, are peeces of other Copper, melted one time lesse, then  
your brick Copper, where of some of them weighs 200, 300. yea the greatest 600 lb. a peece, The  
tinne is mixed amongst the Copper, and Bell-mettal, that they maye runne the better in melting, which  
makes your peece more solid and firme.

But in Italy *S. not* Alexander Bianco (as Mr. Norton one of his maies. master Gunners, and Enginier citeth in  
his practise of Artillerie) saith, That the best Alligations of these mettals for Ordnance is for every 100. lb. of Cop-  
per 20 lb. of tinne, and 5 lb. of *brasse*, or Latton is to be mixed therewith. And Diego Vffano a Spaiyard, Capitaine  
of the Ordnance in the Castle of Antwerpe, in his instruction of Artillerie affirmeth, that the best ligature for  
Ordnance is 100 lb. of Copper, 8 lb. of tinne and 5 lb. of Latton, and 10 lb. of *Sow*-lead, affirming that lead being  
rough & cold; maketh the peece become hard. But le Sieur de Brissac, a french man in his militarie discourses saith,  
that the French Founders vnto every 100 lb. of Copper doe either ad 20 lb. of Bell-mettal, which is 25 pound of  
Tinne & Lead for 100 lb. of Copper, or *brasse*, or else 10 lb. of soft tinne to every 100 lb. of Copper.

The Lords the States haue in the Hagb a very braue founderie; and a work-house ioyning to it; in which they doe all  
their massive workes, and behinde that a spacious room; where they sett and place all their carriages, which is kept faire  
and dry, and besides the Master Founder hath a house to dwell in, all which belongs to the Land.

The Master Founder must be very carefull in making choise of his powders & Earths wherewith he is to make his  
Mouldes for the Casting of *brasse* Ordnance in, that they be able to resist the fire; and receiue the melted mettals: So  
that they maye render them to be cast; and founded neatly; without being Subject, either to be diminished, cracke; or  
peeld, when they shalbe heated, which is such a matter; as without experience cannot be done well. Wherefore, I wil  
conclude with Mr. Norton in his practise of Artillerie, that good Earths are neither satt, nor leane, but betwene both;  
and of a fine and subtill graine or mould; which soone dryeth, and remayneth firme, without breaking; being able to resist  
the vehemencie of the fire, and such Earths are most commonly of a yellow, or a red colour.

Now to finde such Earths, as are fitt for your worke, it becometh you to sinke diuers pits, or Caves vnder ground,  
which haue not bin much stirred. And after you haue begun your worke, and Compounded your Earths in a barke; or  
heap, and wetted, and moistned them like paste, beginn then to heate them with a rod of yron, as the Porters vse to doe  
their Claye. Then take  $\frac{3}{4}$  parts of the whole lump, and mixe it with linn cloath, and then beate the same toge-  
ther, vntill they be well incorporated; that they maye appeare all one substance; and if any small stones should churle  
to fall amongst it, then pick them out; or bruiſe them, as small as maye be, that the powders being well tempered, maye  
serue for your moulds and formes.

## Of makeing of moulds for the founding of Ordnance.



**T**HE Master Founder having prepared, and resolved of what kind, and what sort of that kinde the Ordnance is, which he intends to cast, he it then first to make a perfect modell there of, either of timber, or of Earth, or both, with all the Mouldures, Ornaments, & compartiments, even as you would have the peece to be, which you must thinneley annoint with soft bogs-grease, and then cover it over with a Coluene of the afore said tempered Earth, made and dried by little and litle, augmenting it, untill it be of a Competent strength, and thickness. This Coluene must be made so, as it may be taken into two or more parts, to the end, to take the said modell, or patterne out of yt, and it is to be fortified on the outside, with plates of yron, as long as the chafe of the peece is, and with yron wyres an inch each from an other, and lastly with yron hoopcs a foote, or two assunder, to knock off, and on, as occasion shall require. Their must also be a smooth, and equall Cillender, whose Diametre must be iust the height of the Bore, and made of the same Earth, moulded vpon a stronge Iron square Barre, and vpon a Cord wound about the same, to make therewith the soule, Concave or hollow Cillinder of the peece, by placing yt (by helpe of the Base, and muzzle ring) exactly in the midst of the vacuity of the outermost Coluene, which when the Patterne, or Modell shall be taken out, will remaine hollow, to receiue the mettall, that must make the bodie of the peece. All these must be well ioynted together, polished smooth, dried and nealed, that the mettall maye runne fine, and come off smooth and neat.

Lastly, the patterne of the breech, with all the mouldures, and Cascabels is in like manner to be Couered over, by litle and litle with the same tempered Earth, which must afterwards be Luted neatly, and strongly to the breech end of the outter Coluene: all which mouldures, rings, armes, devises, Flowers, Trionious, Dolphins, and Circles, maye be at pleasure added there vnto, vpon the patterne, either with waxe, earth, or playster, and so the perfect impression thereof wilbe receiued by the Concavity of the out ward Coluene, keeping still the due prescribed proportion of the peeces (yow intend to cast) according to the kind & sort thereof, for the rest se mr. Norton in his 21, & 22 Chapters of the practize of Artillere.

Having thus digressed, I will returne againe to my former matter, and giue the gentle Reader to vnder stand, that the States have Conditioned with their Master Founder, that he shalbe at the charge of makeing all mouldures, formes, castings, borings, and finding of firing, for which he hath from the States six gildens, or 12 shillings sterling, for the founding, of 100 lb. weight; so that for a whole Canon, which weighs 7000 lb. weight, he hath 840 gilders for him and his men, the rest proportionally. Now when any old brasse peeces are to be cast, they are deliuered to him by weight, and he is allowed him ten pounds in euery 100 lb. weight for drossie and wast: for you must vnderstand, that Copper & brasse have much more drossie in them, then Gould or silver, because the finer the *alloye* is, the lesser it will consume by fire.

The greatest number of new peeces cast in the States Founderie at the Hagh, euery year by the helpe of some, 20 men are six whole Canons, twelve half Canons, and sixe long Feild peeces, or demy Culuerins, makeing in all the number of 24 peeces of Ordnance. But of late yeares they cast diuerse sorts of french short Demy Canon, and smaller Drakes, as now the occasion of service requires.

These Ordnance being founded and made, the master Founder is to deliuer them to the States vpon Proofs in the presence of some Commissioners, and the Controulour of the Ordnance, who are to ouersee them, and to take care, that the peece, which is to be tryed, be well loaded with her due weight of powder, and bullet, and rammed well home.

The prooffe of a whole Canon which weights 7000 lb. weight, and carries an yron bullet of 48 lb. weight, must be charged with 32 lb. of fine powder, and with the bullet aboue said well rammed home; but the ordinary charge then of it wilbe noe more then 20, 19, or 18 lb. of fine powder at the least: A halfe Canon which weighs 4500 lb. weight and shootes a bullet of 24 lb. weight, the prooffe Short must be 16 pounds of fine powder & the ordinarie charge 12 lb.

A Feild peece, which weighs 3200 pound weight, carrying a bullet, of 12 lb. must be loaded with nine pounds of fine powder, but the ordinarie charge is noe more but sixe pounds.

The Faulconet, that weighs 2100 lb. which carries a bullet of sixe pound weight, must be loaded with 4 lb. of fine powder for it prooffs short, and with 3 lb. for its ordinarie charge.

Note also, that a Canon, which shoots a bullet of 48 lb. must be bored for a bullet of 52 lb.

Weight, A Demy Canon, which carries a bullet of 24 lb. must be bored for a bullet of 28 pound.

Weight, A quarter Canon, which carries a bullet of 12 lb. must be bored for a bullet of 16 lb.

A Faulconet which carries a bullet of 6 lb. weight, must be bored for a bullet of 8 lb.

Your whole Canon, and Demy Canon, are commonly peeces for Batterie, vied at seiges for to make a breach; but your feild peeces, and Drakes are to be drawne to some suddaine peece of seruice, as in the day of battle, vpon a passage, or vpon plate formes, & batteries made vpon the line of Circumvallation, or for the defence of a Campe, when an ennemy is at hand, and the rest of the short chambered Drakes likewise.

A Canon or a smaller peece of Ordnance, maye shoote in 12. howres some 80 shoot, yea 100, if it be not ouer heated, but after yow have made with it some 10 or 12 shott at the most, it must haue a cooling time, by casting ouer the breech of it a dunck hair cloath a pretie while, and that will coole it enough.

For a whole Canon mounted vpon a block waggon, or vpon its owne carriage, it is commonly drawne in these hollow, and marshie Countries, with a teeme of 15 couple of Lustie horses, besides the Thiller horse,



se, making account, that euery couple of horses, must drawe for their shares 600, yea 650 pound weight if they be well putt to it. A Demy Canon with eleven couple and a Thiller horse, a quarter Canon with eight couple and a Thiller horse, & a Faulconet with foure couple & a Thiller horse, and your smaller Drakes with a number proportionable to the weight abouesaid, yea euen to a small Drake carrying a bullet but of one pound weight, is drawne but with a Thiller horse. The length of the chase of euery peece both reinforced & chambred is noted aboue its figure.

*The*  
**Demonstration of the eight peeces of Ordnance,**  
which are in most vse, vnder the Lords the States service.

And first of foure peeces of Ordnance reinforced Plate A.

**N**umber 1. is a Faulconet Weighing in mettall 2100 lb. Weight, being 10  $\frac{1}{2}$  of a foot long, which shootes an yron bullet of 6 lb. Weight, which being layd leuell by the mettall, otherwise called the Horiozontall leuell 800, by the leuell axis, or dispart, commonly called point black 400, & at the highest range 4090 paces at 2  $\frac{1}{2}$  foote to the pace.

Number 2. is a Field peece, or a quarter Canon, Weighing 3100 lb. being 8 foote and  $\frac{1}{2}$  of a foote long, which shootes an yron bullet of 12 lb. Weight, & carries by the mettall 600, by the Axis or point black 300, and at the highest range 3800 paces.

Number 3. is a Demy Canon, Weighing 4500 pound Weight being 10  $\frac{1}{2}$  foote longe, carrying an yron bullet of 24 lb. Weight, which will shoote leuell by the mettall, or Horiozontall leuell 800, by the Axis or point black 400, and at the highest range 6000 paces.

Number 4. is a Whole Canon, Weighing in mettall 7000 lb. Weight, carrying a bullet of 48 lb. Weight, which shoots by the mettall, or Horiozontall leuell 1000, by the Axis, or point black 500, and at the highest range 7000 paces at two foote and a halfe to the pace.

I referre the Reader to the other ranges specified in the quadrant and table following.

**Of the other foure peeces of Ordnance, called Drakes**  
chambred Plate B.

**N**umber 5. is a small Drake, Weighing 280 lb. Weight in mettall, and is 4 foote long, carrying a bullet of 3 lb. weight, charged with one lb. of powder, which will shoote leuell by the mettall 176, by the Axis, or point black 40 and at the highest range 800 paces.

Number 6. is a Drake Weighing 580 pounds, is 5 foot long carrying a bullet of 6 lb. Weight loaded with 1 lb. of powder, which will shoote leuell by the mettall 196, by the Axis or point black, 100, and at the highest range 2500 paces.

Number 7. is a quarter Canon Drake Weighing 1130 lb. Weight in mettall, is 6 foote long carrying a bullet of 12 lb. Weight, charged with 4 lb. of powder, which will shoote leuell by the mettall 264, by the Axis, or point black 146, and at the highest range 2500 paces.

Number 8. is a short Demy Canon Drake, Weighing 2250 lb. Weight in mettall, is 7 foote longe, carrying a bullet of 24 lb. weight, with 6 lb. of powder which will shoote by the mettall, or Horiozontall leuell 346, by the Axis, dispart, or point black 180 and at the best, or highest elevation 2770 paces.

Note by the Way, that the longer the chase of a peece is, being reinforced & well charged, the further it will carrie its bullet, and the stroak the more violent, as you may see by long Culverings, and slings of some 24 or 25 foote long in chase, whereof the experience hath bin tryed at Arnham in Gelderland, where a long Sling lay vpon a Bulwarke, which shot from Arnham to Negenen being 6 english miles distant one from an other. Again, the Shorter the chase of a peece is, as in these Drakes, the further it carries the bullet, as you may see by their severall ranges.

Yet this doth not alwaies hold true, for Count Maurice Prince of Orange of blessed memorie, tryed once a half Canon vpon the Strand at Scheveling, giving it the due charge of powder, and caused the Canonier to leuell yt vpon its highest range, at 6000 paces, to trye this conclusion, to see how farre it would carry. When it was shot, it caused some two foote and a halfe of yt to be sawne off, made it be loaded againe, shoot it off, and found that it carried its bullet as farre as it had done before.

To conclude, with Touch-holes, I have scene in Ostend vpon the West Bulwark, that some touch holes of Canon, were blowne to great with often and continuall shooting, that I have putt my fist into them. Now such a touch hole being blowne some three or foure inches, maye easily be remedied. For if you bore the hole round, and driue in a serew of yron into it, as thick as your finger, and in the midit of the serew abouesaid, bore a small Touch hole in yt, you shall finde this to last longer & be blowne, then any other way which hath bin invented, for now when ordnance are cast a new at this day, for the preventing of this too much blowing, they vse now to make such a touch hole with a serew, as is here mentioned which will not so soone be blowne great, and as your brasse or Copper Touch holes will.

## The second Chapter.

## Treating of a ladle, a Rammer, of a Sponge, and a Feild Carriage for a peece of Ordnance as shall be demonstrated under the Carriage.

**T**HE figures of a ladle, a Rammer, and a Sponge is represented vnto you vnder the Faulconet, and feild peece, with their iust length, and thickeffe, after which forme you maye make all others for what sorts of peeces you please, and with all obserue, that the bignesse of them must be according to the Dyamitre of the bullet which your peece carries. The length of the ladle vnder the feild peece with the staff and Rammer is 11 foote and 9 inches & a halfe long. The opening of the ladle is a foote and  $\frac{1}{2}$  part of an inch. The brasse plate rounded to the staff, and to the height of the shoot, and due vent allowed is five inches. The staff of the ladle 3 ynches thick made of soft fast wood as Aspe Beech or willow. The Rammer B is 4 inches, turned with hard wood, and the length of the copper ladle a foote and ten ynches, the staff to the neck on both sides is 3 inches thick. The Dyamiter of the bullet is traced out with pricks coming downe from the ladle marked 12 & 3.

The Spunge C. is couered with rough sheeps skinns wool, and nailed to the staff with Copper nails, so that it maye fill vp the Soule or Concavity of the peece whe it is to be scowred and cleared. Note also that the Copper ladle for a peece of ordnance must be threetimes the length of the Dyamitre of the bullet. Such a ladle costs the States 6 gl. 10 stivers, vidz. The staff 2 gl. and 14 stivers for a whole Canon, for a halfe Canon 5 gilders, for a feild peece foure gilders 10 stivers. And the Rammer, the staff, and the Spunge or sheeps skinne will cost two gilders 14 stivers.

You have also in the plate B. figure, 9 represented vnto you the figure of a Carriage for a feild peece with all the Dimensions, ioyns, and parts belonging to yt.

The Naues, The cheeke, called limbres, and the wheeles are made of Elme, but the Transoms, The Axeltrees, the spoakes of Oaken timber, and the fore carriage of the wheeles are made of the same wood, as the former are, but the Transoms are elme and the crosse beames of Oake as the ichnographie of the Carriage Figure 9 shewes.

The Lords the States have agreed with there Master Carpenter, to make them a Carriage for a whole Canon for 134 gilders 10 stivers, namely the two side peeces 15, or 16 foote long, 17 inches broad, and 6  $\frac{1}{2}$  inches thick, for 59 gilders, and to every carriage foure Transoms for 6 gilders. An Axeltree for 4 gilders 10 stivers, The two wheeles 37 gilders 16 stivers, for the framing and making of the carriage for a whole Canon 27 gilders 10 stivers, for an Axeltree 1 gl. 10 stivers, for the making, of the wheeles 10 gl. which comes to in all, as aboue said to 134 gilders 10 stivers, and so the rest of all Carriages proportionally.

## The

## Demonstration, or Terciating of the whole Canon,

Num. 4. and also of the Demy-Canon Drake chambered,

Num. 8. with their seuerall names and parts discribed.

**N**OTE first that a peece of Ordnance is diuided into three parts. 1. The Breech, or chamber 2. the trunions, & 3. the Muzzle, or neck, and the length of the whole peece is called the Chasse, or Colume.

A. is the Cornish, brow, or base ring of the peece.

B. is the peeces neck. C. the peeces Boutill, or Astragall called the mussel Ringe.

D. The Reinforced ring. E. The trunion ring, & these 2 trunions are two spyndles, vpon which the peece lieth in its carriage. E H. is that part of the peece, betweene the Breech, the trunions, & the ears.

F I. is the Calibre, Mould, or the bore of the peece. G. is the touch-hole, and all the metall beinde the touch-hole, is called the Breech. F H. is the Coile of the peece. H. The Casacabel, or the out most pommel or button of the peece. F L. is the mettaline Substance, & thickeffe of the Coile, about the breech of the peece aboue the concave Cillender, otherwise, called the Soule of the peece.

M. is the mettaline Substance at her eares, and Stayes of Gravitic, by which shee is hoised vp into her Carriage. So much of her bore, as containeth the powder, and shoot, is called the chamber, or charge cillender, the rest the vacant cillender, & all the rings circles, and entrenches at her mouth & breech are called the Friezes. To conclude, the ordinarie Canons of Batterie is of substance in their chambers, at their Trunions, & at the muzzle, or necks of the Dyamitre of their Calibres, or boores in thickeffe of metall. And thus much briefly for the demonstrating of any other peece of Ordnance whar soeuer.

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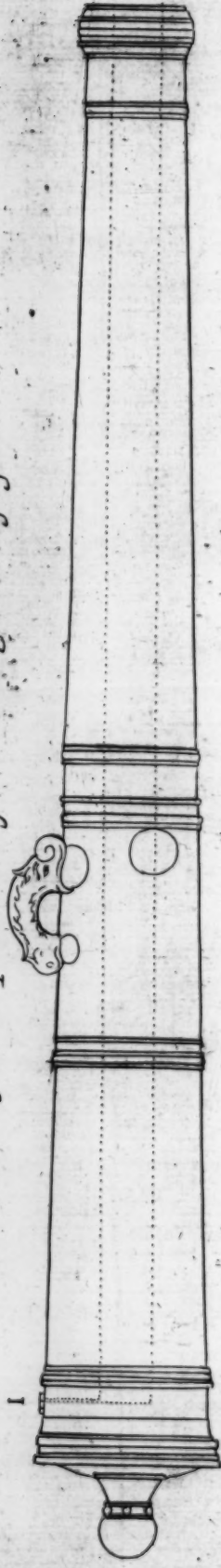


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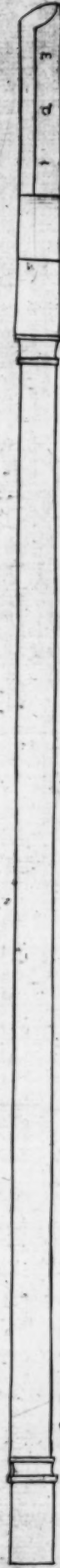
The figures of foure severall peeces of Ordnance reinforced, cast for the States of the united Provinces.

A Falconet of 2100 pound weight the Length  $10\frac{3}{4}$  of a foote



6 PB.

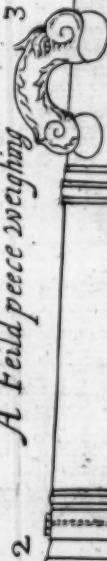
The Diameter of the boore is  $3\frac{3}{4}$  ynches



The Rammer

The Saddle

A Field pece weighing 3200 PB. weight the length 9 foote and  $\frac{3}{4}$



12 PB. bullet

The Diameter of the boore is  $4\frac{3}{4}$  of an ynch.



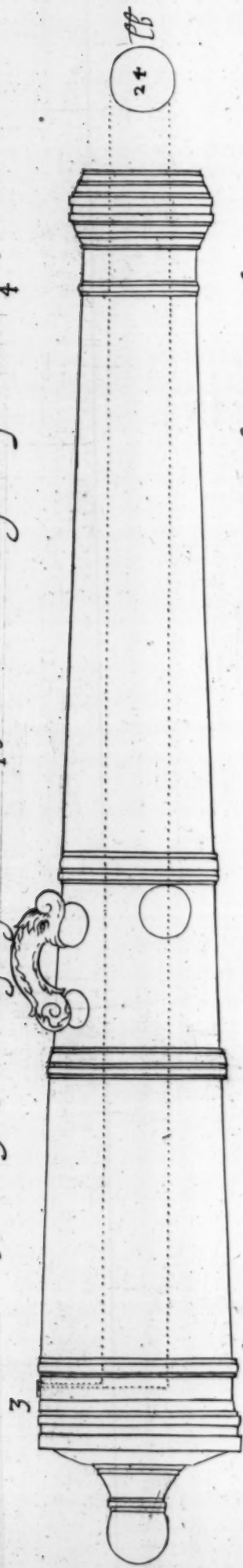
The Rammer

The scouter or  
Sputge.

A Demi Canon weighing about 4500 PB. the Length is foote and  $\frac{1}{4}$

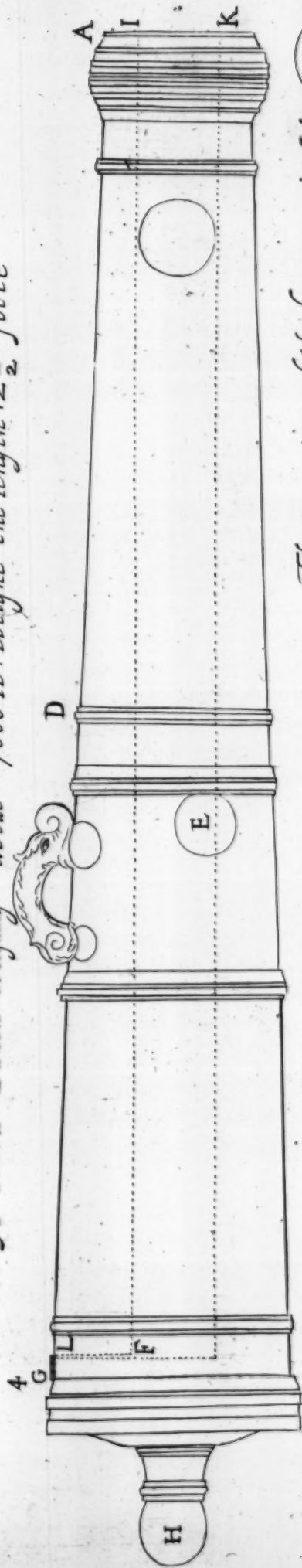
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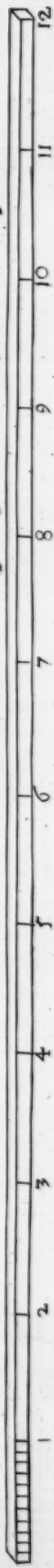
*The Diameter of the Boore is 6 inches*

*A whole Canon weighing about 7000 lb. weight the length  $12\frac{1}{2}$  foote*



*The Diameter of the boore is  $7\frac{1}{2}$  inches*

*The Scale of an English foote at 12 inches to the foote*



A

*Four peeces of Ordnance chambered.*

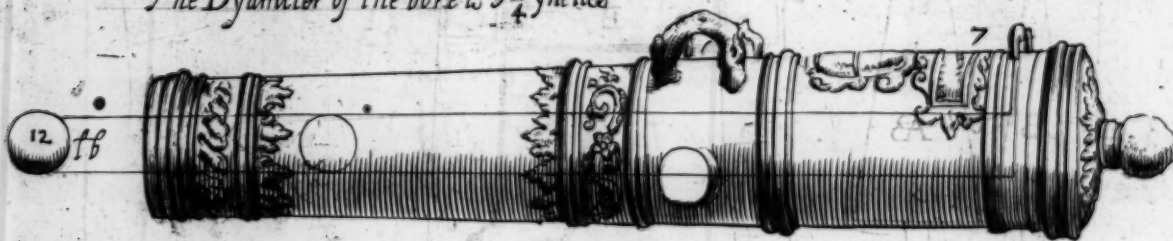
*A Drake weighing 280 lb weight, the length 4 foote.  
The Dyamiter of the bore is 3 ynches.*



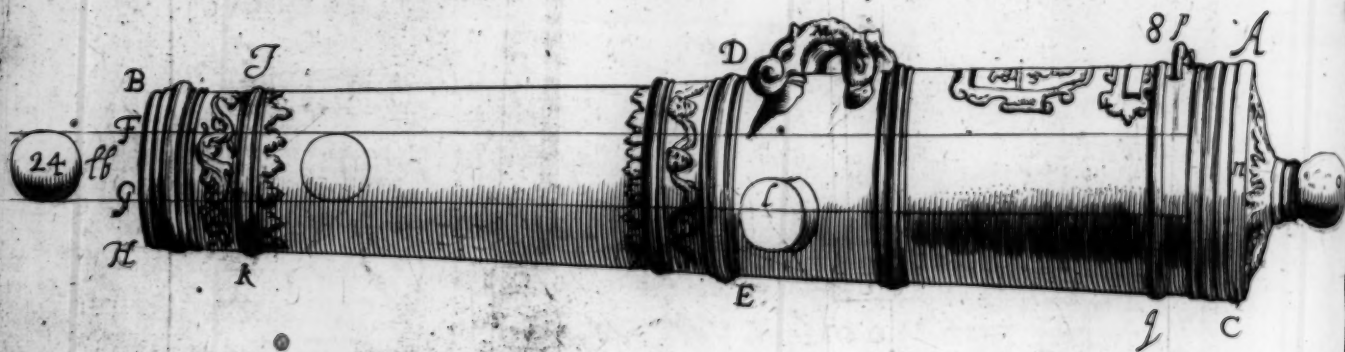
*A Drake of 580 pounds weight The length 5 foote  
The dyamiter of the bore is  $3\frac{3}{4}$  ynches.*



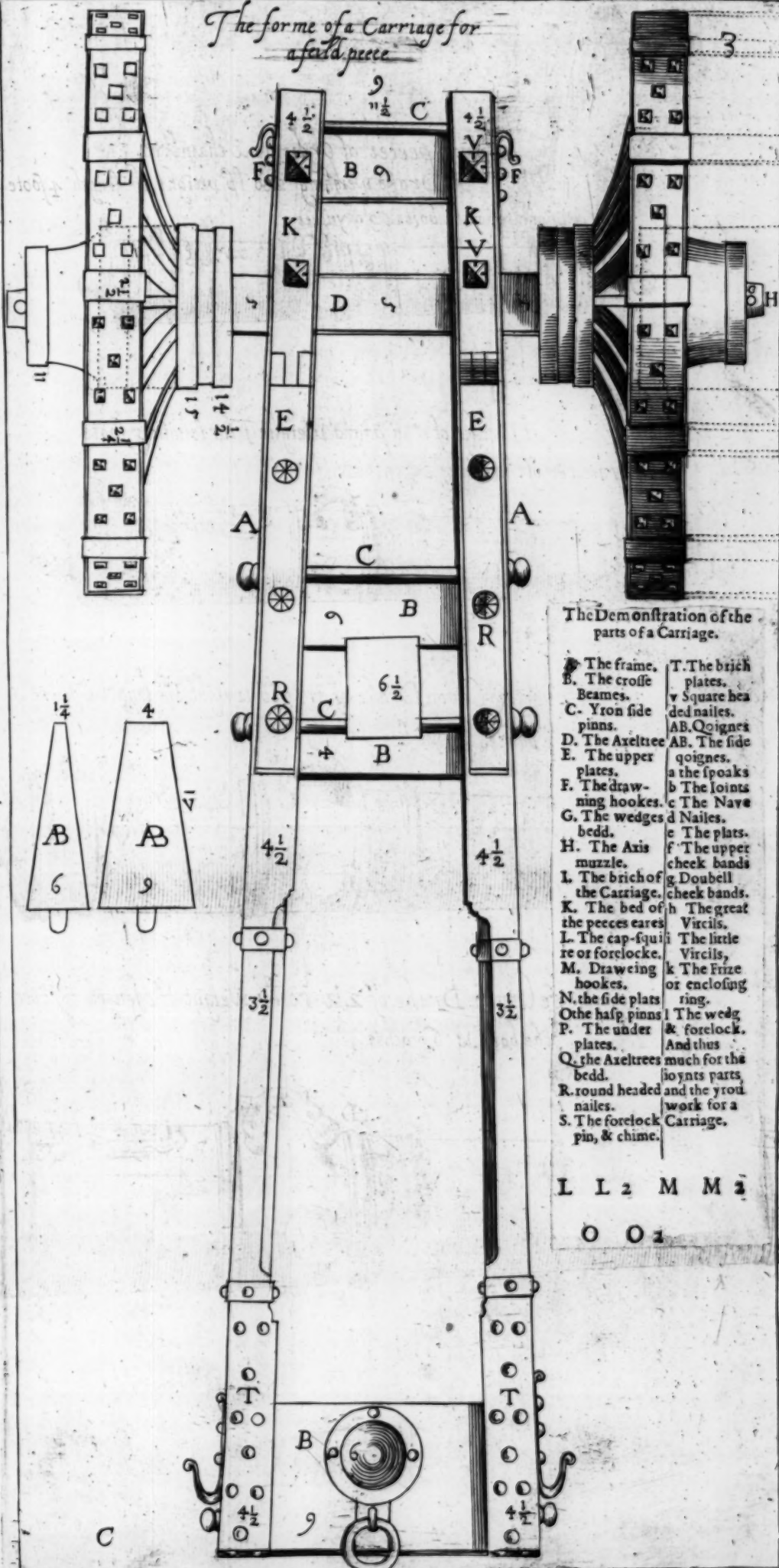
*A quarter Canon Drake of 1130 lb weight The length 6 foote  
The Dyamiter of the bore is  $5\frac{3}{4}$  ynches*



*A halfe Canon Drake of 2250 lb weight the length 7 foote  
The Dyamiter of the bore is 6 ynches.*



*The forme of a Carriage for  
a field peece*



*The Demonstration of the  
parts of a Carriage.*

- |                                     |                                 |
|-------------------------------------|---------------------------------|
| A. The frame.                       | T. The brich plates.            |
| B. The cross Beames.                | V. Square headed nails.         |
| C. Yron side pins.                  | AB. Quignes                     |
| D. The Axeltree                     | AB. The side quignes.           |
| E. The upper plates.                | a. The spoaks                   |
| F. The drawing hooks.               | b. The joints                   |
| G. The wedges                       | c. The Nave                     |
| bedd.                               | d. Nails.                       |
| H. The Axis                         | e. The plats.                   |
| muzzle.                             | f. The upper check bands        |
| L. The brich of the Carriage.       | g. Doubell check bands.         |
| K. The bed of the peeces eares      | h. The great Vircils.           |
| L. The cap-squi re or forelocke.    | i. The little Vircils.          |
| M. Drawing hooks.                   | k. The Frize or enclosing ring. |
| N. the side plats                   | l. The wedg & forelock.         |
| O. the hasp pins                    | And thus much for the           |
| P. The under plates.                | joyns parts                     |
| Q. the Axeltrees                    | work for a                      |
| bedd.                               | Carriage.                       |
| R. round headed and the yron nails. |                                 |
| S. The forelock pin, & chime.       |                                 |

L L 2 M M 2

O O 1







## THE DEMONSTRATION OF THE NEXT FIGURES

following; and first of a Block, or along Waggon.

### THE THIRD CHAPTER.

**T**He first figure underneath number 10. sheweth you of what singular use and accommo-  
dation your *Block*, or *Long waggon* are, for the carriage, and drawing of a peece of Ord-  
nance, or for the carrying of small Punt, or Boats to clapp a bridge on a sudden over a River, or  
a brooke, when occasion may serue: therefore there is no one Instrument more usefull for the  
traîne of Ordnance then this is, and are excellent good also, to stop an *Avenue*, or a passage cross-  
wise, where an Enemies horse may breake in vpon an Armie unawares: especially, when one hath  
no time to cast vpa a trench, or a traverse vpon it. Besides, a peece of Canon will be easlyer  
drawne, through moorish, foule, and sandie wayes vpon this, because the peece lieth more  
steddie, and is not subject to so much wrenching aside in durtie and Ruttie waies, then vpon its  
proper Carriage. Now whensoever an Enemy should draw neere unto an Armie by the helpe  
of the *Fearne*, you may quickly hoize it vp, and laye it vpon its one carriage. The forme and  
modell whereof is represented unto you in the figure following, noted number 10.

The second figure number 11. demonstrates to your eye a halfe Canon mounted vpon its  
carriage, drawne with seven coupple of horse, and a *Thiller* horse, and this to be understood in a  
good way: but if the way be foule, morish, and durty, then for a whole Cannon, weighing  
7000 lb. weight, you must spanne in 15 couple of horse and a *Thiller*; for a halfe cannon eleuen  
couple and a *thiller*; for a feild peece, or a quarter Canon, six couple and a *Thiller*; for a *Falco-  
net* two couple and a *thiller*; and for a small *Drake* weighing 250 pound weight one horse. You  
must obserue also that the mettle of one of the States half canons weigheth (as is said before)  
4500 pound weight, the carriage and yron worke thereunto belonging about 900 pound, so that  
these horses are to drawe in all the weight of 5400 pound, and the other peeces proportionably.

The third figure, number 12. represents unto you this, that when you want or cannot use  
Canon horses and *Athrals*, how you may then by the helpe and strength of men, drawe a peece  
of Ordnance to the topp of a hill, and there to make a *Platforme* for the battering of a Castle:  
Now presuppose you are to batter it with 16 Peeces of Ordnance, to wit, eight *Demy canon*,  
and 8 *Quarter canon*, the first carrying a bullet of 24 li. and the second of 12 li. and are to carry  
along with you all necessaries, as Powder, Bullets, Match, bedding, traces, and diuerse other  
materials. The question is how many Souldiers, Pyonners, and workemen are able to doe this?  
which *Diego Vffano* in his 22 Dialogue resolveth in this manner following.

#### Of a Blockwaggon, and drawing of Ordnance.

First for 600 halfe Canon Bullets, each bullet weighing 24 pound, the whole weight of them  
will come to 144000 pound. Now if yee lay three of these bullets, in a wheele-barrow, they  
will make 72 pound for every Souldier to wheele, and will require 200 men to doe it.

And for 600 quarter canon bullets, weighing 12 pound a peece, the weight of the whole will  
be 7200 l. now putting 7 of these into a wheele-barrow, for every mans share to drue, you must  
haue 86 men in all, and every man as before 72 pound weight.

Item for 168 hundred weight of powder, for to charge these 16 peeces of Ordnance withall,  
each halfe canon requiring 12 pound of good powder for its charge, and for your quarter canon,  
or feild peece 7 pound; you must haue 240 small firkins, or so many leather powder bags to  
carry it in, and giving to every Souldier 70 pound weight of powder, it will require the like  
number of 240 men to carry it, as is represented vnto you in the fourth plate and 12 figure  
following.

Now for the *Attelage* or drawing ropes for these 16 peeces of Ordnance, represented vnto you  
also

also in this fourth plate, and 13 figure, is showne you the manner of it, by dividing your men into three drawing files, or teames, according to the greatnesse of the peece, which your men are to draw vp, for a *Demy canon*, carriage, attelage and all will weigh a matter of 6000 pound weight; now giving to every man 60 pound weight to drawe, such a halfe canon will require 100 men to drawe it, and proportionably the 8 halfe canons 800 men.

For a quarter canon, carriage, attelage and all, will weigh 3000 pound weight, now allowing to every man 60 pound weight to drawe, every of these 8 peeces will require 43 men: so that for these 8 quarter canons you must have in all 344 men, which being (as is sayd) divided into three equall files and distances, each drawing rope must have 14 men and one odd man over, to goe by.

And because it may some times happen, that by reason of the steepinesse, badnesse, and unevennesse of the way, you may be driven to dismount, and remount your peece, ere you get up to the topp of the hill, you must carrie along with you a *Fearne*, a *Winch*, or a *Scalet*, with all appurtenances thereunto belonging, as *Winding ropes*, an yron *Goates-foote*, with a crowe, pinns, truckles, pullies to helpe you withall at a dead lift. All these *Engines* and *Materials* may conveniently be carried on the shoulders of 30 men, in so much that if you make your calculation, you shall finde that you must haue for the drawing of these 16 peeces of Ordnance, and for all things aboue specified, the number of 1703 men, without any difficultie will doe the deede, and drawe these Ordnance whithersoever you please. The *Fearne*, the *Figure*, and its necessaries, shall be described unto you in the next chapter following.

Now for your *Attirals* or drawing harnessse, to the end that every man may drawe alike share, you must fasten a *Crosse beame*, or barre, to the end of your *Fore waggon*, marked as you see with *A B*. through which you putt your *drawing ropes* into an equall distance, that your men may not hinder one another, drawing: having behinde it three men to steere the peece aright, when you come to any winding, or turning by the way.

Againe, if it be a whole *Canon*, or a great peece of Ordnance, which you are to drawe through a trench to a batterie, or some other place, where you would plant it, and finde these drawing ropes to short for the men that are to draw it, then you must lengthen the ropes, and fasten an other crosse barre just in the very middest, and this will guide your peece from wrenching aside; for certaine, the shorter your drawing-ropes be, the more steddie, and easier your peece will be drawne. To every drawing rope also you must haue as many *Neck lines* to cast about your mens shoulders as you haue men, to the end they may draw with the more ease, strength, and take firmer footing. Neverthelesse if you drawe your peece after this manner up to some steepe hill, least the peece should fall downeward and overturne them, for the avoyding of this danger, they must in an instant whipe these lines over their heads to loosen themselves from them, or else cut them on a suddaine; but then it is safer to drawe with their hands.

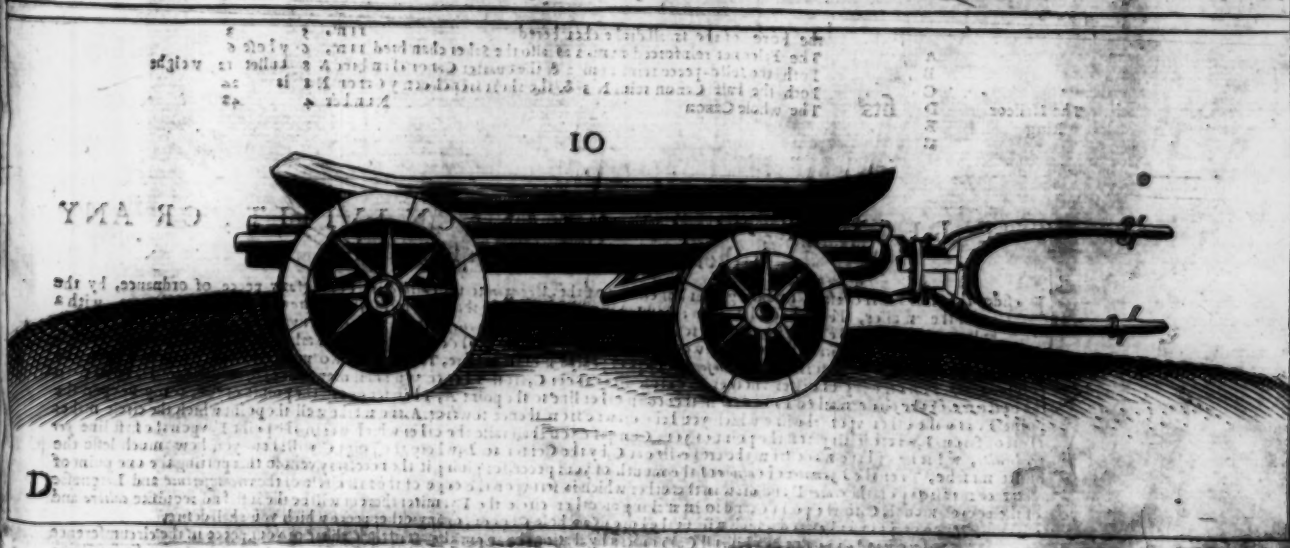
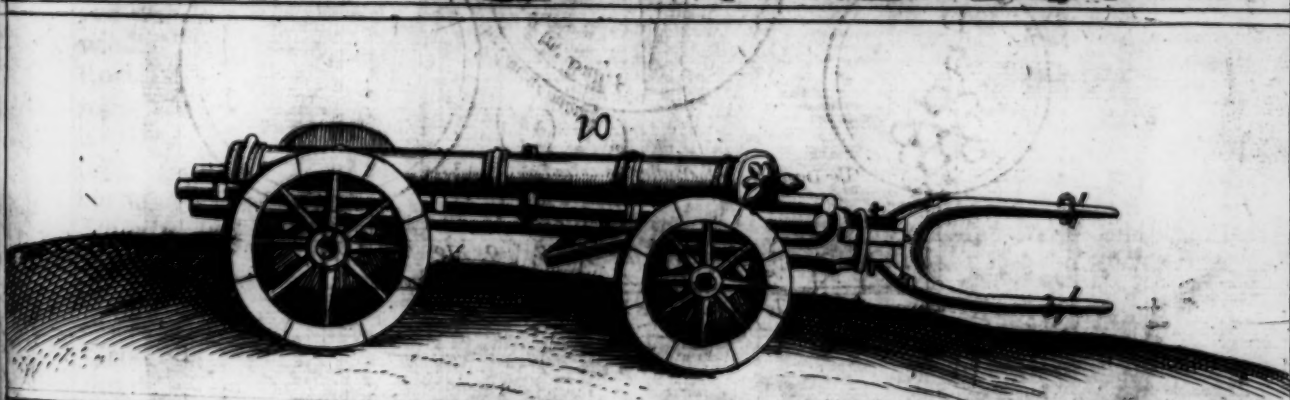
This manner of drawing of Ordnance is no new thing, but hath bin practised by the first *Conquerours* of the *West Indies*: as *Pizarre*, *Ferdinand Cortes*, and diuerse others, who with the strength of men drew their Ordnance over hills and mountaines to the City of *Mexico*. Likewise, *Henry the fourth* King of France, of immortall memory, used this manner of drawing of his Ordnance over the *Alpes* in his last warres of *Burgundie*, and instead of *Pioniers* used Lusty *Swissers* to do it.

The five rings: (called *Mailles* in Dutch) number 14. is to trye whether the bullets which you are to choose in the *Arsenall* will fall through them, which if they do, then they will fitt your peece to a haire, the seuerall *Calibres* and bores of your eight peeces of Ordnance described before.

Practi-

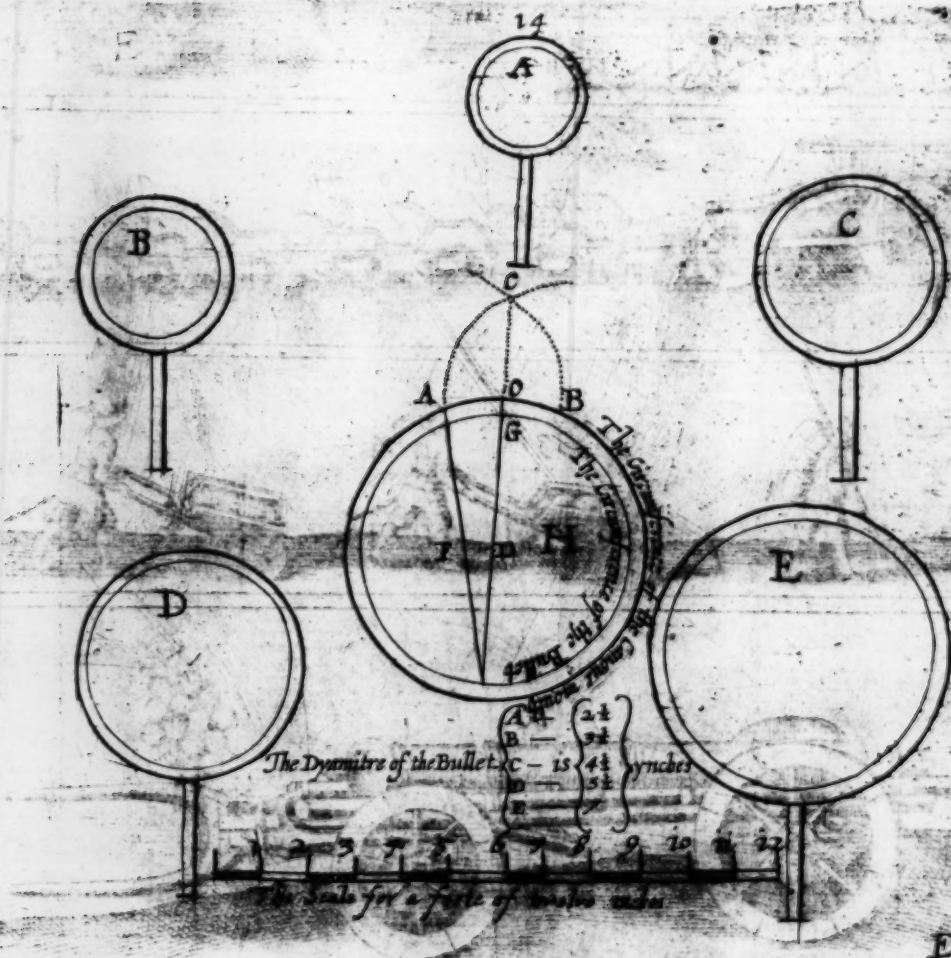
following.







**THE  
RULE OF CALIBRE, TEACHING A CANONIER HOW BY  
The helpe of these five mailes or yron ringed handels, numbred A, B, C, D, E,  
he may fit the Calibres, or Boores of these 8 severall peeces of ordnance,  
figured out above, as also by the middle figure of a Cannon bullet mark-  
ed H, and deciphered also by letters.**



The Maile or Ring	A	the bore of the small drake chambered	num. 5	whole 3	
	B	The Falconet reinforced num. 1 as also the Saker chambered num. 6	bullet 12	weight	
	C	Both the self-pece reinforced num. 2 & the quarter Canon chambered num. 8	bullet 12	weight	
	D	Both the half Canon reinforced num. 3 & the short french demy Canon num. 10	bullet 24	weight	
	E	The whole Canon	Number 4	43	

fits

is

**THE DECIPHERING OF A CANNON BULLET, OR ANY  
other pece. by letters as followeth.**

Besides this manner of finding, by fitting your bullets out of the *Mogax* into the *Calibre* of any pece of ordnance, by the helpe of the mailes, the Canon bullet marked H shewes you also another way to fit the *Calibre* of a pece of ordnance, with a bullet by putting in the requisite vert. As for example take the iust Diameter of the mouth of your pece. with a pair of straight Compasses and divide the *circumference* thereof into two equal parts and draw from the Center the circle marked A and E whose Center also is noted to be E, which is the same & *Circumference* of your peeces mouth or bore. Then set the two points of your compasses upon the points A and B in drawing one after another, the circle lines under C, from whence you shall draw a line perpendicular to D, downe to the bottom of the circle marked E. and from thence an other line to the point A. Then let one of the points of your compasses upon the point E, and the other upon the line which you have drawne from thence towards A and make well the point which the circle makes thereof in F, where letting rest the point of your Compasses you shall raise the other which was in the point E, upon the first line perpendicular, which you have made from the circle-line at C, by the Center to D, where the point C will shew you how much lesse the bullet must be. Then the *Lycimeter* or *Calibre* of the mouth of your pece, for giving it the necessary vent so that putting the one point of your compasses upon the center D and draw in the other which is set upon the edge of the first circle of the *circumference* and Largenesse of the peeces mouth O to the point G, and so in making an other circle the Diameter thereof will be the iust and requisite *calibre* and *Circumference* of your bullet, and which will fit the bore of a whole Canon, or any other pece which you shall desire.

There is a third way for finding out by skillfull Canoniers by abating the twentieth part of the *Calibre* of your pece in the *circumference* thereof, to the bullet which with a sufficient abatement & vent for your pece, which rule is easily found out by taking the iust Diameter of the mouth of your pece.

## OF A FEARNE, A SCALET, AND A WINCH.

The Description of a *Fearne*, called in French a *Guindall*, in Netherduch a *Bock*, from a Goate; with a *Scallet*, and a *Winch*, being of excellent use about the traine of Ordnance.

Represented vnto you in the fifth plate, and 14. 15. and 16 figures following.

### THE FOVRTH CHAPTER.

**T**He Carriage being placed in a readinesse, you are then to hoise vp your peece into it, which in regard of the weight of it, be it a Canon, or any other great peece of Ordnance, cannot be well done without the ingenious helpe of the *Fearne*, or *Ghynne*, ropes, a Goats foote, or an yron Crow, leavers to winde vp the Rouler & c. especially when a wheele is graveled and sticks fast in some deepe rutt, or rotten ground, then you must use the helpe of the *Scallet* or *Winch*; demonstrated unto you in the figures following.

First then you must make and frame your *Fearne*, according to this modell used in the States service, which is accounted the best, number 14: and for the goodnesse of it ought to be preferred before all others, and for the lightnesse of it may vpon a march be layd vpon a waggon to be carried along in the traine of the Ordnance with the *Scallet*, *Winch*, and all appurtenances thereunto belonging. It is made vpon three Feete, Beames, or Supporters, *triangular* wise, vpon which it stands. The demonstration is this, *a. a. a.* are the three feete, which at the top or head of it are industriously joyned together; from *b.* to *c.* is the length of it, some 13 or 14 foote long: it is framed a foot broad, and halfe a foote thick; *d.* and *e.* shewes a great yron bolt with a round head, and at the other end a crosse wedge to clench and joyne it close together. *f. g.* is the Copper hooke and ringe, vpon which the vppermost pullie or Truckle hangeth; *h.* the vppermost truckle it selfe, through which the ropes are let downe and wound vp: *i. i.* the cable or winding rope: *k.* the lower truckle above the Rouler: *l. l.* the Plate worke, within which the Rouler turnes in its bed, and sockets. *m.* is the Rouler it selfe. *n. n.* are the ends of the two ropes well pleated, and bound about, which are to be put through the eares of your peece which is to be hoised vp: *o. o.* the two oblique yron plated feete, vpon which it stands and rests vpon the ground, and by reason they are so made, cannot so easily slip away, or sinke into the Earth, but makes the *Fearne* to stand steadfast, and firme. *p. p.* are the holes into which the two wooden leavers are put into the Rouler and wound vp by two men, the one taking out his leaver to put it into an other hole, while the other with all his strength holds the rouler fast: *q.* are the two winding leavers. *r.* the Goats foote, or yron Crowe, necessary both for the *Fearne*, *Scallet*, and *Winch*. One of the winding ropes must be at least 25 foote long, and in circumference a Geometricall ynh and  $\frac{1}{2}$ ; the ends whereof must be so wreathed and bound fast together that they must not loosen.

The maine rope must be 75 foot long, and 1  $\frac{1}{2}$  of a foote about; the slip must be well wrought and bound about with packthred, which is put through the two holes of the Rouler.

#### *Of a Scallet.*

The other Engine is called in French a *Scallet*, or a Ladderet, in Netherduytch a *Knape*; which must have likewise a strong yron Crow belonging to it, a thick oaken board, vpon which the pillars, or supporters of the weight stands, which are well nigh two foot long and a foot broad, and about halfe a foot in thicknesse.

The two pillars of the *Scallet* must be enchased a quarter of a foot in the thick board, to giue it the more firmenesse, where vpon they stand, and must be a matter of two Geometricall foot high about the said board, and  $\frac{1}{2}$  and  $\frac{1}{2}$  part of a foot thick, each pillar (as you see) having eight holes boored through them at an equall distance one from an other, thorow which you are to put

C

your

your great yron bolt, which with the yron crowe, must sustaine and beare up the ponderosity: unto this bolt there is an yron chaine fastned to it, and nailed to the right hand pillar as you marke: the bolt it self ought to be  $1\frac{1}{2}$  of a Geometricall inch round, and  $1\frac{1}{2}$  of a foote long, each pillar must stand at least halfe a foote one from an other. Vpon this yron bolt, which may be put into any of the holes as you raise vp the peece, and as occasion serues, resteth your yron crow and leauers, and receiveth strength from it to lift vp your wheele peece, and all at a dead lift out of any rutt, moorish ground, or place when it sticks fast in it; and as you raise it, by this engine, you may clap thick fagots, or boards vnder the wheele, till you advance it higher to an other hole.

The *Winch* or *Windlace* represented here unto you in the 14 figure, is called in Netherdutch a *Windaes*, or a *Dumcracht*; and is a differing Engine from the former, but of singular use also for the heaving vp of a peece of Ordnance, carriage, and all, let it be never so great, or any ponderous weight, as blocks, logs &c. yea it is of such great strength and force that it is able to overturne a house, and hath no neede but of one man to put it a worke. Now to make it stronge and sufficient, it must be two foote long at the least,  $1\frac{1}{2}$  foote broad, and  $\frac{1}{2}$  foote thicke, with a vice, and a teethed scrue comming out of the midst of the woodworke of it, and winding up its teeth by the force of two secret wheels turning within the midst of the woodworke. This Engine may also be used (as the former) for the lifting up of a peece of ordnance out of a deepe rut, morish ground, or any durt or mire into which it is sunck; by laying of thick boards, and fagots vnder the wheele, as is said; and this will be done quickly, so that you neede not loofe much time vpon a march: and thus much in brieft for the making and use of these three Instruments. The figures whereof follow in the next page.



HOW ONE IS TO MOVE IT A PITCH UPON ITS CARRIAGE.

By the help of a **Hand** or a **Chance**.

THE FIFTH CHAPTER.

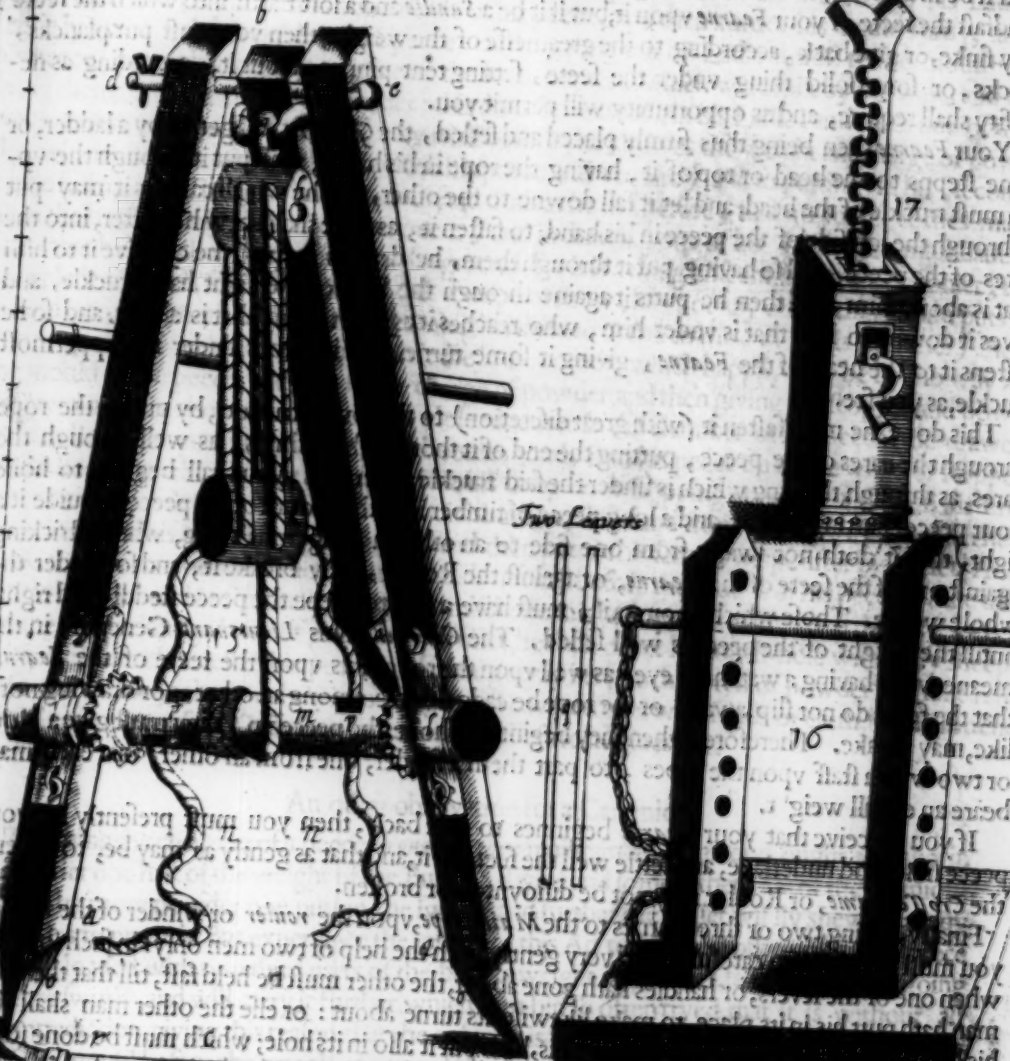
**B**e aware before lunch, for that is about twelve o'clock or fifteen minutes past twelve, that if you are to make your report, you must have finished it by then.

Two Letters

A close-up photograph of a mechanical device, likely a typewriter or printer, showing a complex arrangement of metal parts, gears, and a large, dark, rectangular component on the right side. The image is somewhat blurry and has a high-contrast, almost black-and-white appearance. The mechanical parts are intricate, with various levers, springs, and gears visible. The large rectangular component on the right has several small, circular holes or indentations. The overall impression is one of a well-engineered but somewhat aged piece of machinery.

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**The**



## HOW ONE IS TO MOVNT A PEECE VPON ITS CARRIAGE,

by the helpe of a *Fearne*, or a *Ghynne*.

## THE FIFTH CHAPTER.

**B**Efore you are to moult your peece, above all things you must have a singular Care that the *Fearne* be so firmly set, that it doth not recoile or slip away in any manner, and so that the rope, and pullie, or truckle, coming downe from the head, fall just vpon the eares of the peece; whereof to be assured, you may let fall downward from the pullie aboue, a whipcord with a plummet, or some small stone hanging downe: and turning the said *Fearne*, till the *Plummet* falls just in the very midst, as is said.

If it be in a *plaine*, *even*, and fast ground, you may have the lesse care in setting firme and steadfast the feete of your *Fearne* vpon it; but if it be a *Sandie* and a soft Earth into which the feete may sinke, or give back, according to the greatnesse of the weight, then you must put plancks, blocks, or some solid thiug vnder the feete, setting tent pinnes about it, according as necessity shall require, and as opportunity will permit you.

Your *Fearne* then being thus firmly placed and settled, the *Gunner* shall get vp by a ladder, or some stepps to the head or top of it, having the rope in his hand, shall put it through the vppermost truckle of the head, and let it fall downe to the other, that he which catches it may put it through the left side of the peece in his hand, to fasten it, as wee shall shew hereafter, into the eares of the peece, and so having put it through them, he drawes it vp till he can give it to him that is aboue him, and then he putts it againe through the hole of the right hand truckle, and gives it downe to him that is vnder him, who reaches it againe to him that is above; and so he fastens it to the head of the *Fearne*, giving it some turnes, till it comes under the vppermost truckle, as you see.

This done, he must fasten it (with great discretion) to the lower truckle, by putting the rope through the eares of the peece, putting the end of it thorow three times, as well through the eares, as through the ring which is under the said truckle: after this, you shall beginne to hoise your peece, putting a great, and a long peece of timber into the mouth of the peece to guide it a right, that it doth not swagge from one side to an other; a dangerous thing, which striking against one of the feete of the *Fearne*, or against the *Rouler*, may breake it, and so hinder the whole worke. Those which moumt it, must have a care to keepe the peece steddie and right, untill the weight of the peece is well settled. The *Generall* or his *Lieutenant Generall*, in the meane while having a watchfull eye, as well vpon the ropes, as vpon the feete of the *Fearne*; that the feete do not slip away, or the rope be cadgeld one among an other, or drawing not a like, may breake. Therefore, when they beginne to hoise the peece vp, they must give a blow or two with a staff vpon the ropes, to part them a sunder, one from an other, that each may beare an equall weight.

If you perceiue that your *Fearne* beginnes to give back, then you must presently let your peece sinke, and underlaye, and settle well the feete of it, and that as gently as may be, to the end the *Crosse beame*, or *Rouler* may not be disioynted, or broken.

Finally, giving two or three turnes to the *Maine rope*, vpon the *rouler* or winder of the *Fearne*, you must winder it vp carefully, and very gently with the help of two men only: in such sort, that when one of the levers, or handles hath gone about, the other must be held fast, till that the other man hath putt his in its place, to make likewise its turne about: or else the other man shall stay his hand, till that his fellow drawing out his, hath put it also in its hole; which must be done so often, till the peece be hoised so high, that you may put your Carriage vnder it.

Also you must take heede that your peece knocketh not against any part of your *Fearne*, which might cause any *disaster*, or that the *Fearne* might breake, and letting the peece fall, a mischief may happen, and put all into disorder: wherefore you must put the carriage under it very gently, that the *Tronions* may fall just into the holes or clasping sockets of the carriage, and so guide your peece by the beame which it hath in its mouth, that it falls softly to rest vpon its carriage, and then locking it well in, and fastning it with the wedges, you may then loosen your ropes, and taking away the *Fearne*, your peece being thus mounted you may draw it whithersoever you please.

Practi-



# HOW A CANONIER OUGHT TO CHARGE A PEECE.

## CHAPTER VI.

**A** Peece being brought to a *Batterie*, and planted upon a *Platforme*, having powder, bullets, his linstock, scowrers, Rammers, and all things else in a readinesse, after he hath stuck down his linstock in some place under the winde, and first carefully cleared his peece with his scowrer and sheepe-skin within, and sees that the touch-hole be not stopped, or any dust or filth cleaving to it, then one of his Companions, which is to assist him, (for commonly there must bee two Canoniers to every Caion, or great peece of Ordnance) brings him the *pouch barrell*, with powder iust before the mouth of the peece, and putting his Ladle or charger into it, fills it, and least it might be overfull, giues it a little iogg, that the *Surplus* may fall downe againe into the barrell, after this he puts it gently into the mouth of his peece, even till the end of his Ladle comes up to the very brich and touch-hole of his peece, and then turnes his Ladle softly, and lets it lye within the chamber of the peece, and drawing out his Ladle almost to the mouth of his peece, puts it back againe to take up the loose cornes, which were spilt by the way, and to bring them up to the charge of powder: this done he drawes out his Ladle, and takes out of the *pouch-barrell* a second Ladle full (for by triall before, he knowes the weight and charge of powder, which his Ladle will hold, and which his peece will require) and so putting in his second Ladle full up to the former, drawes it out, and doth as he did before, that no loose cornes may lie in the bottome of the mould of his peece, and in drawing out of his Ladle, he must haue a care, that he let fall any powder upon the ground, for it is a thing unseemely for a Cannonier, to trample it under his feete. Then he takes a wispe of straw, hay, or any other thing: and puts it so hard into the mouth of the peece (turning his ladle to come to the end of his Rammer) hee driues up the wispe and carries up with it the loose cornes, which happily may be by the way in the mould of the peece, even up to the charge of powder, and then giving the stopper and powder, two or three shoues, to make it lie close together in the chamber of his peece, he drawes out his Rammer, puts in his bullet, which rouses gently into his peece up to the wispe or stopper which keepees up the powder (all this while his *Companion* stopping the *touch-hole* with his finger, that no powder flies out of it, but that it be also well filld and stoppt with powder which hee may do out of his *touch-borne* afterwards) and then puts in his second wispe after his bullet. And the Canonier is to be forwarned, that he stands not iust before the mouth of his peece, while this is a doing, but aside of it, least a danger or mischelfe might happen to him, and thus the peece having its due charge both of powder and bullet, he shall cover his touch-hole with a dry sheep-skin, after he hath levelled his peece, and setting away his pouch barrell of powder with the rest, in some *Concaue*, or hollow hutt into the ground covered over with sodds or earth, he shall attend the Gentlemans of the Ordnance his command before he giues fire.

### An other observation for a Canonier.

Touching the charging of a peece *Frons-berghen* maintaineth, that one ought to take in powder one half of the weight of the Bullet. Rivius and some others are of the opinion, that the more powder one puts in, the swifter and further the bullet wil fly shewing many reasons to proue it. But experience the mistris of this Art teacheth us otherwise: for a peece being loaded with two third parts of the bullets weight in powder, sends the bullet going more swiftly, and will carry it further, which hath bin so often tryed, that it is without all contradiction, giving this reason, that the *exhencia* is so swift and violent, that it bursteth out of the mould before the two third parts of the powder be fired, and this hath beene found irrefutable.



Again others maintain, that if one should forcibly ramme in the bullet then the powder might take fire, ere it could cast out the bullet, and then would cause the bullet to fly further then otherwise it would do, But you must consider in so doing, you either endanger the breaking of your peece, or else make it crooked and unseviceable, because your ordinary peeces will not bear so great a charge of powder, this hath bin tryed upon the Sea strand at Scheveling by the Hagh in Holland before his Excellency prince Maurice of famous memory, where first one and the same peece was loaded with ten pound of fine powder to see how far she would carry her bullet. The place being marked where the bullet rested, shee was loaden again with 9 pounds, which shot as far as the ten pound did, but last of all shee was charged but with 7 pounds of the same powder, which carried her bullet further then the two former shots: whence one may obserue that a peece of Ordnance may be overcharged and therefore a good Gunner ought to haue a singular care to giue his peece her due measure and charge.

Of the Gunners service in generall.

**N**OW forasmuch as Ordnance are Engins of force, reason, waight, & measure: & the Gunners men exercised & experienced in them, & their apurtenances in making platforms with defences, Troniers, Gabbions, Loopes, Parapets of earth, & Faggots about 23 or 24 foot high, of Faggots of 2 foot high of earth, bed upon bed vnto eleaven foot high, & after 3 foot of Terraplenc, to raise the Troniers and Loopes, so that for the Cannon it be 3 foot wide in the Barb & within 12 foot wide without the lower part therof to defend scarpwise the better to discover the Enemies auenews, and offend them the more freely, for auoyding the blast and smoake, and ruine, it would else make: For the Culverings 2 foot & a halfe within & 9 foot without will suffice, & for lesse peeces, lesse measures. If the Battery be to be made with Gabbions, they being filled with earth without stones, moystned, & rammed 7 foot a peece in dyametre, 3 rankes between 2 peeces, if the place will permit or 2 at the least, and 3 rowes also one before another, setting one between two, so if the 1 ranke haue 3, the second will haue two, & the third one, but it will be hard to make a safe Battery with Gabbions, Cannon, or Culvering prooffe: And each platforme is to haue 30 foot for the reverse of the Cannon, and 27 foot for the Demy Cannon, he ought to see that it be levelled, or rising 1 foot for 20 backwards the better to stay the reverse and facility, the bringing the peece being loaded to the Loop: He ought to search and examine, the goodnesse of the peeces, their Ladels, Rammers Spunges & Tampion, fitnesse & roundnesse of the shot, force and goodnesse of the powder and match; And to see all fitted accordingly, & to place the powder covertly, hid safe from the fire of his owne as also of the Enemies Ordnance, to see the Gunners take their markes toward the under part, giving each under Gunner his charge.

# HOW A CANNONIER OUGHT TO LAY AND LEVELL

his Peece and to amend a bade short,

## CHAPTER VII,

**H**AVING time and Command to lay and Levell a Peece, according to the ordinary ayme, to try how farr it will cary, the *Canonier* shall take a long ruler, and laying it vpon the midst of the *Frizes*, as well of the brich, as of the *muzzle* of the peece, and a levell vpon it, he shall raise it, or sinke it, untill the plummet of the Levell be iust in the midst: then taking away both the Ruler and the Levell, he shall see even with the *Frizes*, the point or marke which this ayme discovers, which without doubt will be the place it will cray too; with which according to the levell of the mettell, whereof wee will speake hereafter, it will make but the halfe.

But if he hath no leisure so to use the *Ruler* and *Levell*, he may take his ayme, or lay his peece, as he finds good, according to the charge, and proportion of his peece. If he strickes his marke, he may then be assured, that his ayme is right, and using the like weight of powder, will alwaies make the same shot.

But if his bullet carries over, he shall levell his peece againe as he did before, and having got the first marke in his sight, he shall neither sturre nor moove his peece: but shall take away as much of the *Frizes* of the brich, till he sees the blow which the bullet gave, and which will bee the true, and right sight, which he presently may trie by laying his peece upon his first marke, which without any doubt he will strike.

Now if his first shot fals short, then he must doe as he did before, levelling his peece againe, & then without mooving it, he shall goe and take away the *Frizes* from the *muzzle*, till hee discovers the blow of the bullet, and then he shall haue the true sight; according to which, laying his peece upon the first marke, hee will surely strike it, if that there bee no fault in the powder.

There is an other way of levelling of a peece, and amending of a bad short, in adding or diminishing the elevation, according to discretion. To witt, when he shootes short of his marke, the peece is remooved and layd as before, afterward he raises up the *Muzzle* as he shall iudge, and as neede shall require, that he may strike his desired marke, observing well alwaies how much this elevation is made higher then his first ayme taken, which he shall perceiue if looking even with the mettell, he shall see what marke it will show him.

### *How a Cannonier ought to Levell his Peece.*

Then giving fire, and striking the marke before ayimed at, he may be assured, that his peece carries right, to which henceforward hee shall giue as much height aboue the naturall Levell: if it failes, that is, if he over shootes his marke, let him dispart that which his first shot fell too short, with the length of the same, for the lessening of the Elevation proportionably, in doing whereof, without all question hee shall see his short remedied, and a right short made. And this is your common and ordinary way in which Gunners do most exercise themselves in, with assurance that he which knowes not by this meanes to giue the right elevation and range to his peece, is not worthy of the name of a *Cannonier*. Now for his better understanding I will giue him this example.

Suppose a *Canon* be mounted upon his carriage, and planted upon a *plate forme*, and is to make a shot at some *white-stone* or marke in a Wall. To doe this, your Gunner must take his ayme as curiously as possibly he can Levell with the mettell of his peece, but if his shot fals two short, to helpe it he shall take his ayme againe, and shall lay his peece as hath beene taught before: afterward he shall raise it a point higher, so that whereas he had but 6 before, now he hath 7 points of the elevation, and afterward giues fire. If he stricks his marke let him alwaies take the same ayme and Levell. But if he over shootes his marke, let him levell his peece as is taught before: by disparting the difference of the first, from 6 with that of seven points, as discretion shall guide him, according to the carriage of the first shot, and giving fire, (without all doubt) he shall hit his desired marke. And his Peece being thus raised he must keep in his sight the point or marke which is showne him, and obserue well the height which is aboue his marke, with assurance that when he is to make more shot by keeping this elavation he wil never faile. But if the first shot lying upon the 6 points be to high, then he shall helpe that by the same Rule in laying his peece lower, & so shall strike his marke whereby he shall get credit and commendations for it.



A new devise by any staffe, to leuell, mount, and imbase any peece.

**A**lso any peece, may with a field *Linstock*, *Rammer*, or *Spung*, or other *Staffe* be mounted to any degree of the Quadrant, being thus prepared, First, marke from one end of that Staffe a distance, equall unto the height of the Pomell or Caskabell of the Peece, placed leuell upon her plat-forme, and then take the distance between the Centre of the Trunions and the Pomell or Caskabell, which make or imagine a semidiameter of a Circle, & divide it by diagonals or paralels, or otherwise into a 1000 equall parts. Lastly out of the table of *Sines*, take the number answering to every degree out of the said 1000 parts, and set that distance from the said mark downwards. And if the total *Syns* of the Table be 100000 omit the two last figures of each number thereof toward the right hand, & if it be 1000000 then omit 4 figures of each number you finde in that Table & the remaineing number will shew how many of those 1000 equal parts are to be set downwards from the mark beneath the said leuell for each severall degree: Then drawing also 10 Paralels or Diagonalls from the first degree to the second, and from the second to the third &c. successiue continued from each to his next, noting every degree with Arithmetically characters, so you may from six minutes to six minutes by those right signes mount the peece. so set forth for any peece which it shall be prepared for. This may also be described upon such a Staffe without the Table of synes in a mechanically manner thus, If you describe a Quadrant or quarter of a circle with a semidiameter, equall to the distance from the centre of the Trunions, to the centre of the Pomel or Caskabell and deuide the Arch of that quadrant into 90 equall parts or degrees, and then from each degree letting a line fall perpendicularly upon the base side of the said quadrant: And lastly, each of those right lines being thence transeferred from the said first marke downwards vpon the said staffe, and marking them with Arithmetically figures for each degree, therevpon making also Paralels and Diagonalls as afore-said you may thereby Geometrically and mechanically marke the same from 6 to 6 minutes as before. The vse of them are plaine and easie, for if you bring downe the centre of the caskabell or Pomell of the peece to any number of the degrees thereon so marked, for that peece, you setting the lower end of the staffe to the plat-forme being even, although it be rising or descending backwards: I say then the Axis of the bore of that peece will be found to be elevated unto the degree assigned: If you be to imbase the peece, those lines & number also set about the first named mark, will performe the like office there, in the thing required.



# OF A QVADRANT LEVELL, AND OTHER INSTVMENTS

for Ordnance, and the use of them.

*The forme, proportion, and making of a quadrant and a Levell, with an instrument to shew the use of it, is very necessary for master-Gunners; and Canoniers, for the Levelling and ayming of Canon, other Ordnance, and Morters, demonstrated in the first plate, and 15. 16. and 17 figures following.*

## CHAPTER VIII.

**T**O make a *quadrant*, as is fitting, one must first make the whole circle marked 1. which is divided by lines, running from its center into 48 equall parts, at the end of each is noted the number thereof, enclosed in a space between two little lines within an other circle, and between two *Vergets* or small rings, where you see there is a space also, by which the said line is divided equally in the midst.

With a quarter of this circle is made your *Quadrant* marked (2) being from 1 divided into twelve points, making seven degrees and a halfe, so that in all they make 90, which is iust the fourth part of the 360 degrees of the whole circumference of the world.

It may also be divided, as you see upon the white, each on the outside, into 45 points, whereof every of them make 8 degrees: so that the whole 360 degrees are comprehended within them, according to this forme and devision is made your other *quadrant*, noted (3) and is marked with, A. B. and C. divided into 9 equall parts, each of them making 10 degrees.

Now by these two *quadrants*, the plummet hanging in the midst from the point of the 45 degree, which are also divided into two equall parts, is showne to you the highest elevation and range of a peece, yea as farre as ever the peece is able to carry at length, as you may see in the figures following of a Canon and a Culvering.

The like is also showne you by the *Levell* marked (4) for the ayming, and levelling of peeces, when you are to take your marke aright, which also is usefull for the making of your *platformes*, and beddings for Ordnance, all which are necessarie for the Art of Gunnerie.

This may also be made by a *quart* of the former Circle, if you divide it into 12 equall points, and so noted and ordered, that you must beginn to count from the midst of it, towards the ends or sides to the 6 point, so that your *plummet*, being upon the 6 point iust as the others, you shall finde that your peece is layd at its highest elevation and range.

The *Cartabon* (or your fouresquare levell) marked 5, comprehends also all the circle abovesaid, and is divided into 48 pointes, according to the foure quarters of the world, that is, *East*, *South*, *North*, and *West*, making also foure particular *Quadrants*, whereof the forked dart comming from the center, or midst, shewes all the lines, not onely of the *Circle*, but also of the *Quadrant*, or your foure square levell, and running in a line from the midst, marked with O and N or with O and S, it will make a *Levell*, and is in the first degree of the right *Quadrant*, but comming from the midst, and betweene the said lines, it will shew you your highest elevation, as the other *Quadrants* have done. The handle noted E. F. (if it be possible) must be 2 foote and a halfe long, whereof each foote must be 16 ynches, to the end it may make iust 40 inches, that is 3 foote and foure inches of our ordinary foote, which is an ordinary pace, or halfe a Geometricall one.

### *Of a Quadrant Levell, and the use of them.*

Each of these ought to have in the midst, & at the end a little hole going from the one side of the handle to the other, which serve for this use, that this instrument being set upon the brich of your peece, looking through one of them aboue the highest *Frizes*: you may giue a shroud gesse how farre your peece will carry the bullet, according to the length, condition, and proportion thereof. The two pins which you see on the sides of it, marked C F serve to this end, that thereby you may discern the quality of the place, which you would measure, the point designing by its fall from the East towards the North, the length, bredth, depth, and height of the same. Finally this instrument containeth many misteries of great consequence, and is of excellent use both for an *Inginier*, and a *Canonier*.

The common rule, whereby a *Canonier* may know how farre his peece will carrie, and how farre from one degree to an other, according to the *elevation* thereof, let him first see how many

paces it will carry being layd *even with the mettell*, which afterward he shall devide by 50. and multiply the *Quotient* by 11. and that will bring out the number of the further digression or ange, which if he devides againe by 44. he shall then finde the quotient to bee the iust number of paces: which the bullet will loose in the other ranges degree by degree: as for example, A battering Canon will shoot its bullet being layd even with the mettell, a thousand ordinary paces, at 2 foote and a halfe the pace, which being devided by 50 your *quotient* will giue twentie, which being multiplied againe by 11 it will giue 220 paces, which is the number of the next digression made in the second degree of the *Quadrant*, or the first after the Levell abovesaid.

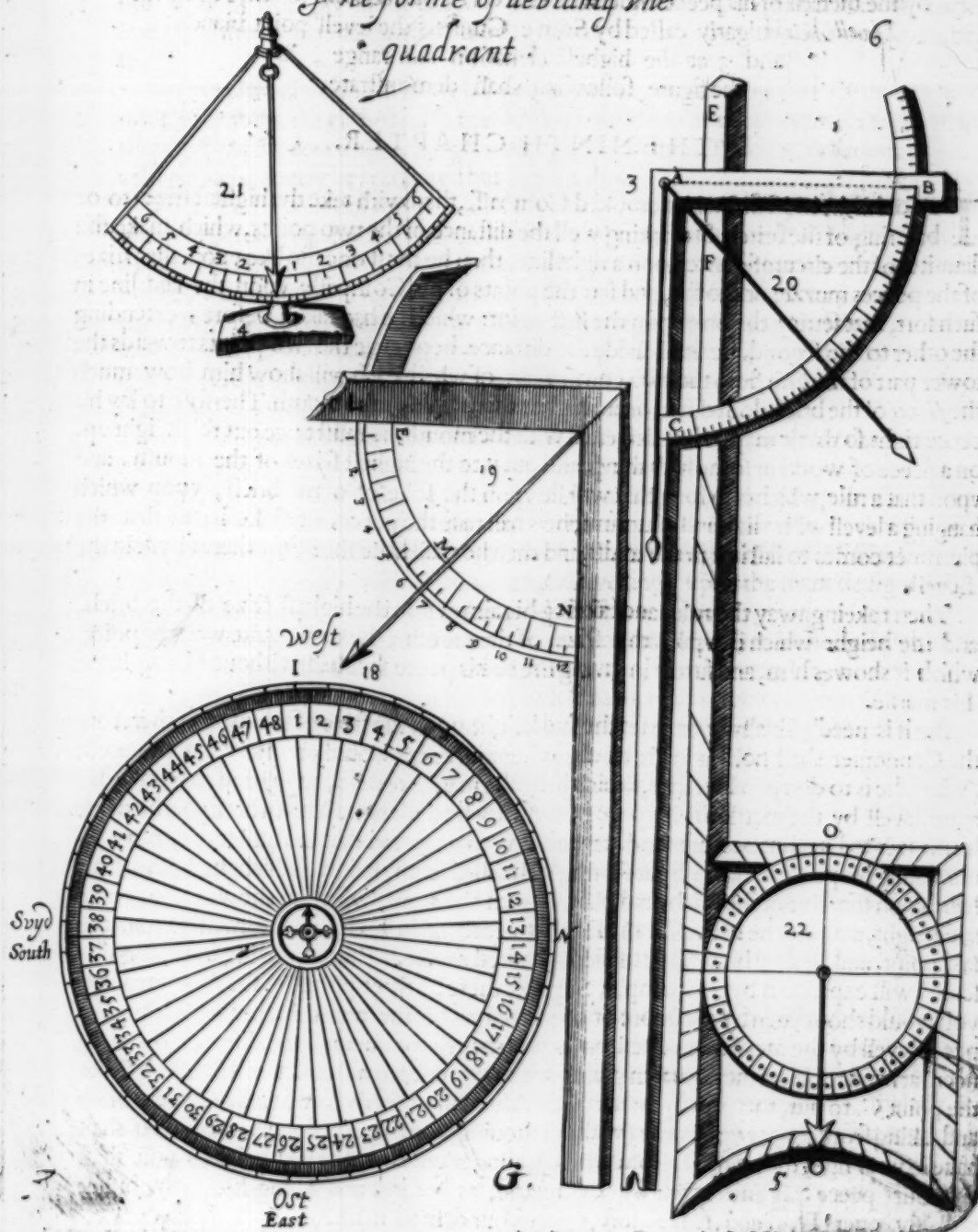
But all the other *digressions* or *ranges*, do alwaies diminish even unto the five and fortieth degree. To know then what this diminishing is from degree to degree, even unto the 45, which is the higheft elevation, you must take the iust number of the digressions from the first to the 45, which wilbe 44. now deviding them by the former number of 220 paces, you shall find your *quotient* to be 5 which is the number which goes alwaies decreasing from the first to the last digression: so that your Canon being layd upon its naturall marke, in which it is raised a degree above the levell, even with the mettell, making 1000 paces as is said, being layd upon the second degree, adding 220 paces to it as an advantage, then it will carry the bullet 1220 paces before it stopes. Again you may add the same to the third degree, but the former being the greatest digression, as wee haue taught this then, and all the others will alwaies diminish 5 paces and will make but 215 above the 1220 of the second degree, so that you shall haue in your third degree 1435. paces. In the 4<sup>th</sup>. degree 1645. In the 5<sup>th</sup>. degree 1850 paces. In the 6<sup>th</sup>. 2050. paces. In the 7<sup>th</sup>. 2245 paces. In the 8<sup>th</sup>. 2435. In the 9<sup>th</sup>. 2620 paces. In the 10<sup>th</sup> degree, which is the first of the *Quadrant* of 9 points it wil be 2800 paces. In the 11<sup>th</sup>. 2975. In the 12<sup>th</sup>. 3145 paces. In the 13<sup>th</sup>. 3310. In the 14<sup>th</sup>. 3470 paces. In the 15<sup>th</sup>. 3657. In the 16. 3775. In the 17<sup>th</sup>. 3920. In the 18<sup>th</sup>. 4060. In the 19<sup>th</sup>. 4595. In the 20<sup>th</sup>. degree, which is the first of the second point, 4325 paces. In the 21. 4450. In the 22. 4570. In the 23. 4685. In the 24. 4795. In the 25. 4900. In the 26. 5000. In the 27. 5095. In the 28. 5185. In the 29 degree, 5270 paces. In the 30. which is the beginning of the third point, 5350 paces. In the 31. 5425 paces. In the 32. 5595. In the 33. 5560. In the 34. 5620. In the 35. 5675. In the 36. 5725. In the 37. 5770. In the 38. 5810. and in the 39 degree. 5845 paces.

In the 40. point, which is the beginning of the fourth point, 5875. paces. In the 41. 5900. In the 42. 5920. In the 43. 5935. In the 44. 5945. Lastly in the 45. when you reckon but foure halfe points of the *Quadrant*, you haue the higheft elevation or range as you shall see in the figure following, which maketh 5950 paces.

To conclude, a skilfull Canonier exercising himselfe herein, will easily conceiue, and know certainly how to Level his peece vpon any one of these degrees and points, and how farre it will carry be it great or little: for this calculation will never faile him, by observing this, that in giving the chase or elevation of his peece, in what point soever it be of this rule or degree reaches from 1 inch to 16. which is a Geometrical foot, the next chapter following shal shew him the vse of it in levelling of Ordnance after three maner of wayes, to wit, *even*, or *levell with the mettelle point-blanke*, or upon a *higher elevation* at a range.

Practi-

The forme of deviding the  
quadrant





SHOWING HOW A CANNONIER SHALL SHOOT LEVELL

by the mettell of his peece, otherwise called *The Horizontall Levell*,<sup>2</sup> or by *the Levell Axis* vulgarly called by Some Gunners the levell point blanck,  
and 3 at the highest eleuation and range, as  
the figure following shall demonstrate.

THE NINTH CHAPTER.

**T**o do this, he must first take a crooked Compasse, therewith take the highest frizes to or basering of the brich, & marking well the distance of the two points, which make the diamiter of the circumference vpon a right line, then he must doe the like vpon the frizes of the peeces muzzle or mouth, and sett the points of his Compasse vpon the said line in such sort, that setting the one vpon the first point: which he had taken before, extending the other to the second, he shall divide the distance, betweene the two points towards the lower part of the line, into the two equall parts, of which each will show him how much the frizes of the brich doth differ, or are higher then those of the mouth. Therfore to lay his peece right, so that it may be levelled euen with the mouth, he must trace out this height vpon a peece of wood or some such thing, and put it to the highest frizes of the mouth, and vpon that a rule, which is so long that will lie vpon the frize of the brich, vpon which hanging a levell with a line and plummet, he shall raise the peece, or sinke it, till that the plummet comes to fall iust in the midst, and then he shall haue the boore thereof right in the Levell.

Then takeing away the rule, and takeing his aime vpon the highest frize of the brich, and the height which is vpon the frize of the mouth, he shall marke well the point, which it shoves him, and surely in giving fire to his peece, he shall without failing strike his marke.

But it is needlesse allwayes to set the said height vpon the frize of the mouth, therefore the Cannonier shall hold it in his hand, whensoever he would shoote vpon this point (which he is to do vpon batteries, which haue the marke neere enough) and shall take his aime levell by the mettelle of his peece, as vsually he doth till he hath in his sight the mark he meanes to hitt, but because the distance being to neer, and that the bullet may carry ouer, leting his peece stand without stirring it, he shall set the height, which he hath in his hand vpon the frize of the brich, and observe well the point which it shoves aboue, the said height, and after he hath it, he shall lay his peece again levell by the mettelle vpon the said point, and he shall hit without faile his desired marke. but this being something obscure I will explaine it by an example, Suppose there be three points as D. A. C. and that you would shoot euen by the boore of the levell vpon the point A. you must lay your peece levell by the mettelle, but questionles you shall shoot ouer it, the distance being to neere at hand for his aime, so that in giuing fire to your peece the bullet will come to strike the point C. to hitt, then iust vpon the point A. you must set the said height vpon the brich and taking from thence your aime (without mouing your peece downwards) you shall haue in your sight the point D, from which hauing taken away the said height, you shall lay your peece againe levell by the mettelle, as before, and giuing fire, the bullet will fly ouer D. and strike iust vpon your desired marke A.

If occasion were, that you would shoot at a mark: which is to far for the aime, levell by the boore, and notwithstanding is so neere for the ordnance levell, a Canonier must vse this discretion, to witt the distance being a third part further he must then take away a third part of the height, and if it exceeds the carriage of the levell two parts, then he must also take away two parts & he shall shoot so right, that if it were for a wager he would hit a shilling or at least a hat without fayling.

This is your ordnance pointeries against batteries, which according to the instruction giuen before, one ought to approach, as neere anemie as one can, so that if you do not  
take

take heed to lay alwaies this heighth upon the brich of your peece, you will alwaies over, shoot your mark, contrary to the desire of a good Canonier, which is alwaies to beat up on the foot, or foundation of a wall, that it may tumble down, and be battered the sooner for the easier entrance of a breach, observing that it is one of the principallest considerations in all shots, that in making a good shot one levels his peece at the foot of his mark, especially in shooting at a troupe of horse, or a company of foot. But in a stony place, a Canonier doth willingly shoot short, because in striking upon the stones or bricke, in rayfing them, he makes a hole much greater, then the bullet which goeth through them.

But in a plain place one must lay his peece so, as the bullet may take them iust in the middle, or about the girdle, and so may kill a whole file, or a rank at a shot, yea though they should all fall flat down upon the ground, yet they cannot all escape, otherwise if you leuell too high, it may be accounted but as a lost shot.

To amend then a shot too high for this mark, you must leuell your peece upon the white or marke you shoot at, then going to the mouth of your peece with a leuell line, and a plummet, and take there the height of the highest frize, or ring to the bottome of the boore, which you shall set to the frize of the brich, and from thence, and about the frize of the mouth, you shall take (without stirring the peece) your aime, marking well the place it will shew you, then taking away the said heighth, you shall lay your peece again upon the point it showed you, and so without sayling, you shall hit the mark you desired.

But if your peece carries too short, it must be amended in this manner, lay the peece as before, then going to the mouth with your line and plummet, take all the heighth of the frize from the top to the bottome, in such sort, that your line may take the whole Dyametre of all the circumference thereof, and by this dyamiter, you shall take the thickeffe of the mettle from the bottome of the boore, even to the lowest part of the said frize, and laying this heighth upon the brich of the peece, and levelling it up on the mark designed, which you would shoot at, you shall see the good effect it will take.

Now for a shot that is made on either side of your mark, it is to be helpt in this manner following, if the bullet falls on the right side of it, then you must lay or mooue your peece, and take your aime so much on the left hand, and that you may not faile a fiftes-breadth, now to make the distance of the one and the other side alike, you shall leuell your peece as before, right upon your white, then take a long ruler, which you shall lay upon the frizes, as well of the brich, as of the muzzle, & leaving it upon the mouth, you shall take your aime removing it at the brich so long, till you have got in your sight the place of the side shot, which your bullet made, and without taking away your eye, or your hand from this sight, removing the brich of your carriage, till the brich of your peece, comes to be right in the midst under the said ruler, which being done, take away the ruler, and take your aime level by the mettle of the peece, and you shall find your peece to be turned iust, as much towards your left hand, as it shot before on your right hand.

Moreover, there are many occasions, which may cause a bullet to straggle, either on the one side, or on the other. The first is, when the boore is boored more on the one, then vpon the other side, or by reason of the inequality of the mettle, or that, the mould is not right. This cannot be imputed a fault in the Canonier, but in the Founder: neuerthelesse, if he be ingenious, he may helpe this fault by his discretion trying his peece by his creuse & inor scaling primer, and so help it as the fault may require.

A Peece also will carry fidelings, if the tronions be not iust right the one ouer against the other.

Also if the platforme be not layd even, but that the one part is higher then the other.



*The Principles of the Art Military.*

Item if a Canonier in taking of his aime stirs his eye from the iust middle of the frizes of the peece, and though he hath it, yet he may faile in not taking his aime iust in the middle of his mark.

Item if one wheele be higher then the other, the shot will fly alwaies toward the lower side.

Item if one of the wheelles should stay upon a naile, and the other not, as likewise when the one turns more easily then the other, and if one wheele should stand upō dirty ground and the other on hard, or when one of the Cubes, or heads of the wheele is longer then the other.

Item when the bullet is not driven home alike, or lies more upon the one side of the boore, then upon the other. And Finally the straying of the bullet upon the one side may be caused by the vehemency of the winde, when it cannot be holpen.

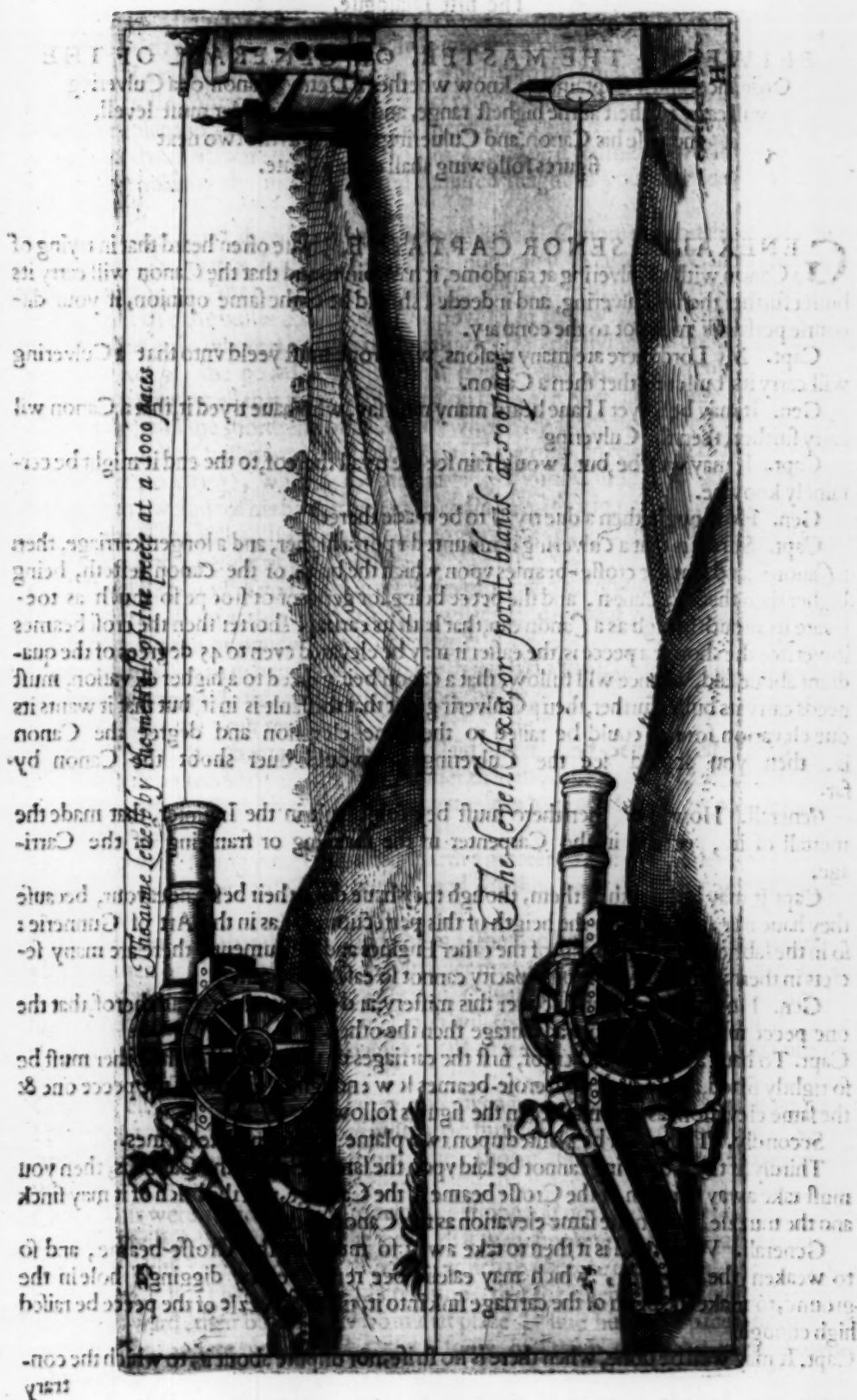
Likewise a short or an overshot may be occasioned either by the force or the weaknesse of the powder, or by reason of the unskilfulnesse of the Gunner, who knowes not to lay and levell his peece aright, neither knowes the true distance of the mark wher at he shootes.

All which I have marked at large, not as a matter to excuse an inexperienced Canonier but to giue advise to the wise, to haue a vigilant eye upon all things, and to follow the rules aboue said, and so to prevent all inconveniences: for to faile the first time may passe, the second may be pardoned, but the third time is to much & cannot be excused, because it is a certain signe of want of discretion and iudgment. And indeed there is no fault as we have shown but by discretion may be remedied, whereof we have seen many examples at the famous siege of Ostend, wherein a sound iudgment was shown in this kind, whereof I will relate two examples.

A ship running into the haven to get into the towne, which brought the Enemy some provision, a woman sat at the helme of the ship, to make us ashamed, order was given to a Canonier, that he should make a shot at this steeresse, who thinking it was too cruell a thing to shoot at for weak a sexe, offered to take away the helme from between her hands, and to make the boate come floating towards us, with the floud: if she were not provided with an other, which he presently put in praize, letting his peece so right and discretely, that indeed shooting of the helme, it fell into the water, and this boate came floating towards our quarter, where it was pillaged, and burnt in sight of our Enemies.

An other ship lying at anchor, staying for a high water to come into the Towne, our men to sink it, made many Canon shot at it in vaine, iudging that the distance was too farre to do it any harme: where upon they were forbidden to shoot any more at it, and not to spend their powder to no purpose: but at last there came a Canonier who promised not onely to strike the ship but also to shoot the Cable asunder so that by fauour of the water the boate should come floating to our mercy, and indeed levelling his peece, and giuing fire to it hee shot the Cable in peeces, and to the great admiration of all our army, the boate came swimming to our quarter. These examples I have related and will do others in the following Chapters, to shew the skill of a good Canonier that hath discretion and iudgment in such occurrences, and to giue encouragement to all Canoniers and Gunner to doe the like when occasions shall serue.





## The first Dialogue.

BETWEENE THE MASTER, OR GENERALL OF THE Ordnance, and a Captaine, to know whether a Demy Canon, or a Culvering will carry furthest at the highest range, and how a Canonier must levell, and raise his Canon, and Culvering to try it, as the two next figures following shall demonstrate.

**GENERALLO SENOR CAPTAINE**, I haue often heard that in trying of a Canon with a Culvering at randome, it hath bin found that the Canon will carry its bullet further then a Culvering, and indeede I should be of the same opinion, if your discourse perswade mee not to the contrary.

**Capt.** My Lord there are many reasons, which one must yeeld vnto that a Culvering will carry its bullet further then a Canon.

**Gen.** It may be so, yet I haue heard many men say, who haue tryed it, that a Canon will carry further, then the Culvering

**Capt.** It may well be, but I would faine see the tryall thereof, to the end it might be certainly knowne.

**Gen.** How ought then a due tryall to be made thereof.

**Capt.** Sure it is that a Culvering is mounted vpon a higher, and a longer carriage, then a Canon is, and that the crosse-beames vpon which the brich of the Canon resteth, being higher then that of a Canon, and the peece being longer cannot slope so much as to elevate its mouth so high as a Canon can, that hath its carriage shorter then the crosse beames lower: for the shorter a peece is, the easier it may be elevated even to 45 degrees of the quadrant about said, whence will follow, that a Canon being raised to a higher elevation, must needs carry its bullet further, then a Culvering, not that the fault is in it, but that it wants its due elevation, for if it could be raised to the same elevation and degree the Canon is, then you should see the Culvering, would ouer shoot the Canon by far.

**Generall.** How so? then there must bee some fault in the Ingenier, that made the mettall of it, or else in the Carpenter in the making or framing of the Carriage.

**Capt.** It may be in both of them, though they haue done their best endeavour, because they haue not attained vnto the heighth of this perfection: for as in the Art of Gunnerie: so in the fabbricking and framing of the other Engines and Instruments, there are many secrets in them, which a common capacity cannot so easily find out.

**Gen.** How shall we then discover this mystery, and to haue a sure tryall thereof, that the one peece may haue no more advantage then the other.

**Capt.** To haue a true tryall thereof, first the carriages of the one, and of the other must be so rightly fitted, and locked with crosse-beames low enough, to giue both the peece one & the same elevation, as you may see in the figures following.

Secondly. They must be planted vpon two plaine and euen plate formes.

Thirdly, if the Culvering cannot be laid vpon the same height as the Canon is, then you must take away so much of the Crosse beame of the Carriage, that the brich of it may sink and the muzzle ly vpon the same elevation as the Canon doth.

**Generall.** What need is it then to take away so much of the Crosse-beame, and so to weaken the Carriage, which may easilie bee remedied by digging a hole in the ground, to make the brich of the carriage sink into it, till the muzzle of the peece be raised high enough.

**Capt.** It may well be done, when there is no strife, nor dispute about it, to which the contrary

trary part is will never agree, because of giving an advantage.

Gen. What advantage can there be in this, to have a peece to ly vpon a plate-forme, & to have the brich of the carriage sunke a little into the ground.

Capt. I am of that mind, that a peece, which hath the brich of the Carriage steep from recoyling, will shoot its bullet with a greater force and violence, then that which lies freet upon an explanado, or a plat-form, And therefore to give no advantage to a Culvering, it is better to shue off some of the Crossbeames, to cause it to sinke lower, then to ly in such a ditch by raising the mazzell to the required height as you may see in the figures follo wing.

Gen. I have heard diverse disputes among good Comoniers touching this point, Who thought that a Culvering, could not carry so farre as a Canon, because this peece being long, the bullet must go a longer way from out the chamber to the mouth, and that before the bullet comes out, the powder in that while may loose some of the strength thereof, whereas a Canon being shorter, and the flying of a bullet out of the Canon shorter, the powder will send it going with a greater strength.

Capt. I believe well that there is some reason for what you alledg for the length of a Culvering, and the shortness of a Canon; when they are charged with that quantity of powder, as their bullets require: but for your Culvering, in regard of the length of it, you give it a greater charge, whereas for the charging of your Canon, you give it in powder but halfe the weight of his bullet, and to an ordinary Culvering, you give it in powder, or the weight of the bullet, but being a Culvering reinforced, you may give it as many pound of powder as the weight of your bullet.

Gen. I will demand of you Sir one question more, and therewith conclude this discourse, If you were to shoot at ships upon the Sea, what peeces would you choose to be the best either your Canon or your whole Culvering?

Capt. Of this you may be assured from one that hath found it by experience, that there is no better peeces to do this then your Canon.

Gen. Give me your reason?

Capt. Your Canon being shorter, may be laid lower, and better levelled, considering also that their bullets are greater and weightier then the others, & if in the descent, because neither the wind, nor the humidity of the water, can have any such great power to dead or hinder their flight.

Gen. How so? seeing your Culvering taketh a greater charge of powder, then your Canon, as you even now confessed is better, and will ding away the bullet with a more violent force.

Capt. My reason is that the wind and the moistnesse of the water have more power over a lighter, then of Canon bullet, which is heavier then a Culvering, now if you were to shoot at a ship of a like distance, you must raise your Culvering to your thinking two pikes length higher then the ship is, whereas your Canon will require but one pikes length of elevation above it. Therefore I have made many a tryall of it at the siege of Ostend, both of a Canon and of a Culvering.

Gen. Well Sir you have satisfied mee, and given mee good reasons for what you say: but I pray yet tell me whether a peece will carrie furthest, which is shot out of the Sea to the landward, or that which is shot from the shoare side, along the superficies of the water.

Capt. This were a hard question to resolve, if one had not made experience of it, Nevertheless I will tell you what I have seen, that wee shooting into the Sea from our batteries in Dunkirke at the Enemies shipping, which rood before the Town, we could scarce reach them, But I have seen with admiration, that the Enemy shooting from their shipping to us ward, their bullets flew from that place, five hundred paces further, then ours did, where wee stood, yet some of them into the very Towne of Dunkirke.

Gen. Surely I was of a contrary opinion, thinking that a peece planted upon the firme ground



ground, the bullet would flye further, and with a more violent force, then that which is shot from a floating ship, because the peece in recoyling shakes the ship, and by the shaking therof, the bullet may loose some of its strength, but these are secrets in nature, more admirable then apprehensible.

Capt. True it is, that there are many hidden and secret misteries in nature, but for this one may alledge some naturall causes: for a bullet shot from a ship to the land-ward, seeketh its naturall resting place: but that which is shot from the land along the surface of the water, the bullet is forced to striue against two elements, that is first against the aire, which retaineth it with all might, and secondly against the moistnesse of the water, which also deads the bullet, causing it to stoope, for this hath bin found, by experience to be true, that a bullet will shoot further into the Sea at a low water, then it will doe at a high Sea.

Gen. If a peece were so planted, that one could shoot both into the land, and also into the Sea, by turning the said peece, the question is, whether the bullet would flye furthest over the Land, or upon the Sea.

Capt. A Canon will carry its bullet a thousand paces further over the Land, then it will do upon the superficies of the water, and though we haue had no certain tryall of it: yet the siege of Ostend hath taught us this experience, that we may be assured of it: For in the channell by Newport, when the battle in Flaunders was fought Anno. 1600. we shot at the Enemyes shipping and men of warre, to make them giue back, that our men might come up along the strand with more safety, and lesse danger to fight, we found that our bullets, which were shot at them from the land, could not reach them to doe them any harme, but the Enemyes bullets, which were shot from their men of warre, shot amongst us, and flew five or sixe hundred paces over our heads.

Gen. That might well be, for perhaps the enemyes peeces were either greater or longer then ours, or else, that they had finer and stronger powder then ours had.

Capt. The Calibres and boores of the one and of the other were alike, for their bullets fitted our peeces, but indeed in the goodnesse of the powder there might be some difference, and for our parts to charge them well, we put a Ladle full of powder more then ordinary into ours, but this would not help. This question I haue asked many times, both of Gunners, & Mariniers, who haue given me alwaies this reason, that it was for some secret cause in nature, that a shot being made into the land, should fly further, then that which was made from the land into the water.

Gen. Though this troubled me a little yet I am glad to heare your reasons, and the experience you have had. But I had almost forgotten to haue asked you one question more, which now I call to mind, how comes it to passe, that all the charge of the powder takes not fire, and is not consumed in a Canon, as well as in a Culvering.

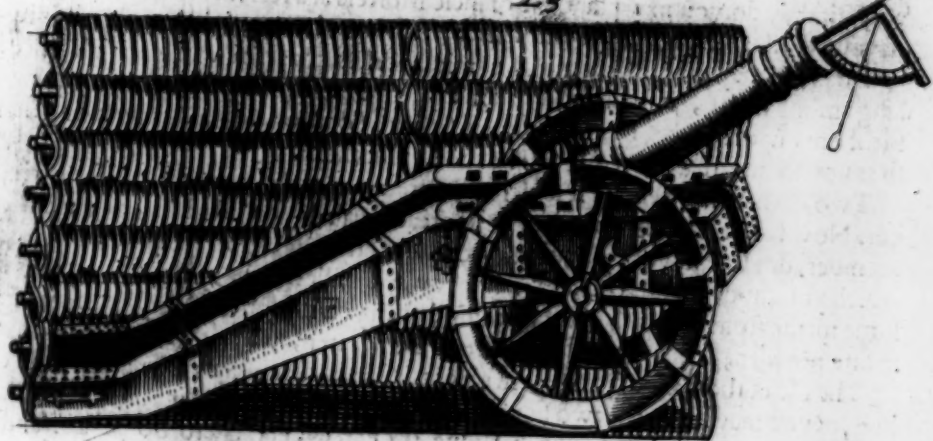
Capt. This is not any fault or aduantage in the peeces, for one would thinke that a Canon being shorter, and of a Larger bore then a Culvering a small part of the powder might bee expulsed or driuen out before it be all fired, and that a Culvering being longe and straight, might keepe it in the powder till it takes al fire, but this is done at a venture, and yet notwithstanding it happens oftner in a Canon, by reason of the biggnesse of the boore, then in a Culvering for after you haue giuen your peece its due charge of powder to ramme it vp some what close into the chamber of your peece, you give it two or 3 shoues with the end of your Rammer, the powder being well corned; there lies ordinarily some loose cornes & dust by the way in the bottome of the mould, which the wispe or stopping hath not driven home, so that if a Canonier, doth not take very good heed, there will alwaies be some part of the powder shed in the peece, which will ly before the bullet, & when the rest of powder takes fire those loose cornes flyes out, & cannot take fire, like as you see also that some shreds and peeces of the stopping after the shot is made, and smoaks without being consumed by fire. So that your lo. may be assured that any peece of ordnance be it either short or long, if the charge of the powder be well stopped and rammed home and some loose

loose cornes which will fly backe gathered well vpon by the wisp, there wil not be so much as one Corne, but will all take fire. This is seene also in the tryall of Bombards, and morters which though they be short, and large mouthed, fire and consume, all their powder, without loosing so much as a graine.

Gen. Now I vnderstand well, and confesse that hitherto I haue bin of the vulgar opinion attributing the cause to the shortnesse of the peece and herewith we will conclude. Here follows the figure of a Canon and a Culvering elevated by leuell vpon one and the same degree of the quadrant to try which will carry furthest at range.

*whether a Culvering or a Canon will carry furthest*

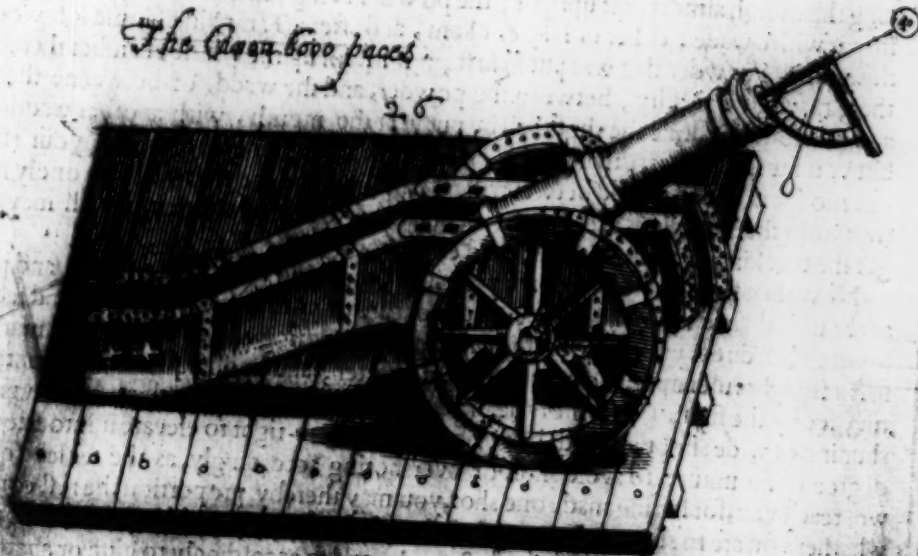
25



*The Culvering will carry 7000 paces*

*The Canon 6000 paces*

26



CONTAYNING THE DEMONSTRATION OF MORTERS,  
and the vse of them.

## The tenth Chapter.

**Y**OUR great and small Morters, are not onely serviceable in a warre offensive, by shooting and casting of great *Granadoes*, as of a 100, 150, 170 pound weight, and smaller of 40, and 50 pound, but also by casting of Fire-balles, stones old rubbidge, and peeces of yron into Cities, Townes, and Fortresses, and may be used also defensiuely, to be shot from Townes, and Forts besieged, into any Enemies workes, and approaches, especially they are of singular use, when an Enemy hath covertly approached, and lodged himselfe under some Bulwark Tower, or Turret, and is a beginning to undermine them, which if they do, you may plant one of these Morters at a reasonable distance, on the inside of your Wall, and shooting your *Granado*, as it were bolt upright into the aire, by its naturall fall, it may light iust into the Enemies workes, and there with great violence, breaking among them, it will make them cry, flye, and forsake the place, you may also fire them out of a place, by casting good store of *land-granadoes* down among them, and so annoy them, that the work will be too hot for them.

Two of these Morters are represented unto you, in the plate and figures following number. Now for the shooting away of your great *Granadoes* or Firebals, you must ever remember, but to take; or, part of fine powder of the weight of your granadoe or thing which you shoot, but if you are to shoot away a bullet without any fire workes in it, or some massie stone, or such like solid thing, then you must take but halfe the weight of it in fine powder, which having given fire to the Morter, will send it going merrily.

The use of them is not to shoot in a right line, as other ordnance doe, but in an oblique line, as you may see by the two figures following, unlesse your mortar be mounted to 90 degrees, incunting them usually about 45 degrees, namely to 60 70 80. and sometimes more or lesse, as the distance, and fall of your *Granadoe* or shot shall require.

Having before shown you the making and use of the *Quadrant*, it remaines now, that I come to the charging and use of a mortar, now before you put in your powder, it must be well sponged and cleared, whether you charge it with loose powder, or Cartouch, turning the mouth almost bolt upright, the powder being put into the chamber, you must stop it with a wadd, either of Hay or okam, and after a Tampkin of some soft wood, and this with the powder that was put in first, it must fill up the whole chamber thereof, that there may be no vacuity, between the powder, and the wadd, or betweene the wadd, and the shot, this done the shot shall be put in at the mouth, with another wadd after it, but you must have a care that your Morter be not much mounted, least your shot flies out too soone, and the wadd between the Tampkin, and the shot will not onely save the shot from the Tampkins breaking of it, but also is to avoid vacuities, which may endanger the breaking of the peece by second expansions.

Now then having resolved of the premisses, touching your peece, shot, and powder, as above said, and upon the distance and monture of your mark, as the rules and tables following shall direct you, then for the bending and disposing of it to the assigned mark, lay first a straight ruler upon the mouth of your mortar, and upon it place a quadrant (as you may see by the figures, or some other instrument close wise, to set the mortar vpright for shuning of wide shooting, and then placing them fore-right to elevate it into the resolved degree of mounture, to avoid short or overshooting accordingly, as the tables following will teach you, for having made one shot, you may thereby, proportion the rest considering whether you are to shoot with or against the wind, or whether it blowes towards the right or the left hand, whether weakely, or strongly, and so accordingly to giue or abate the advantage, or disadvantage, which iudgment and discretion will induce you thereunto, and the helpe of the Rules following.

Now

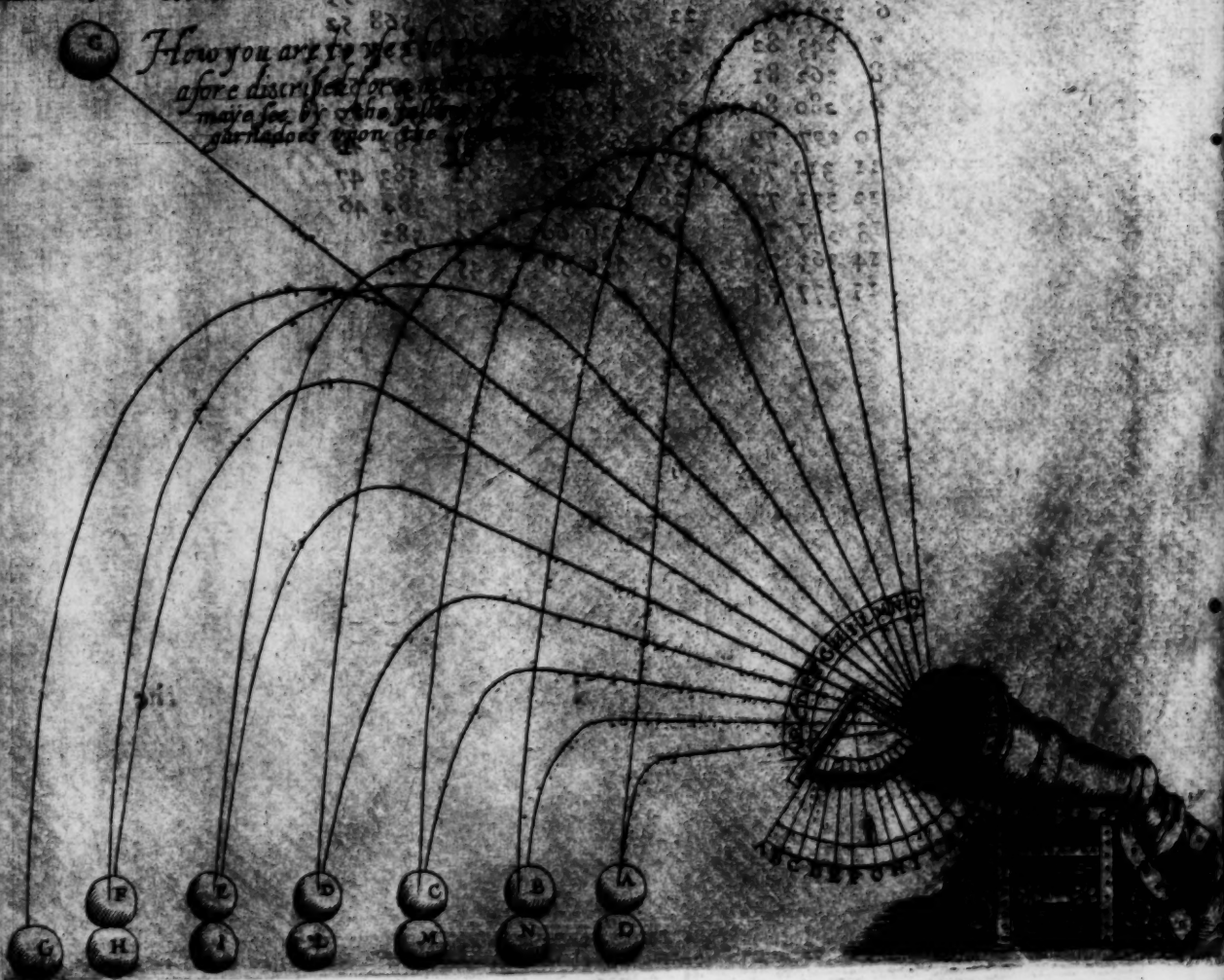
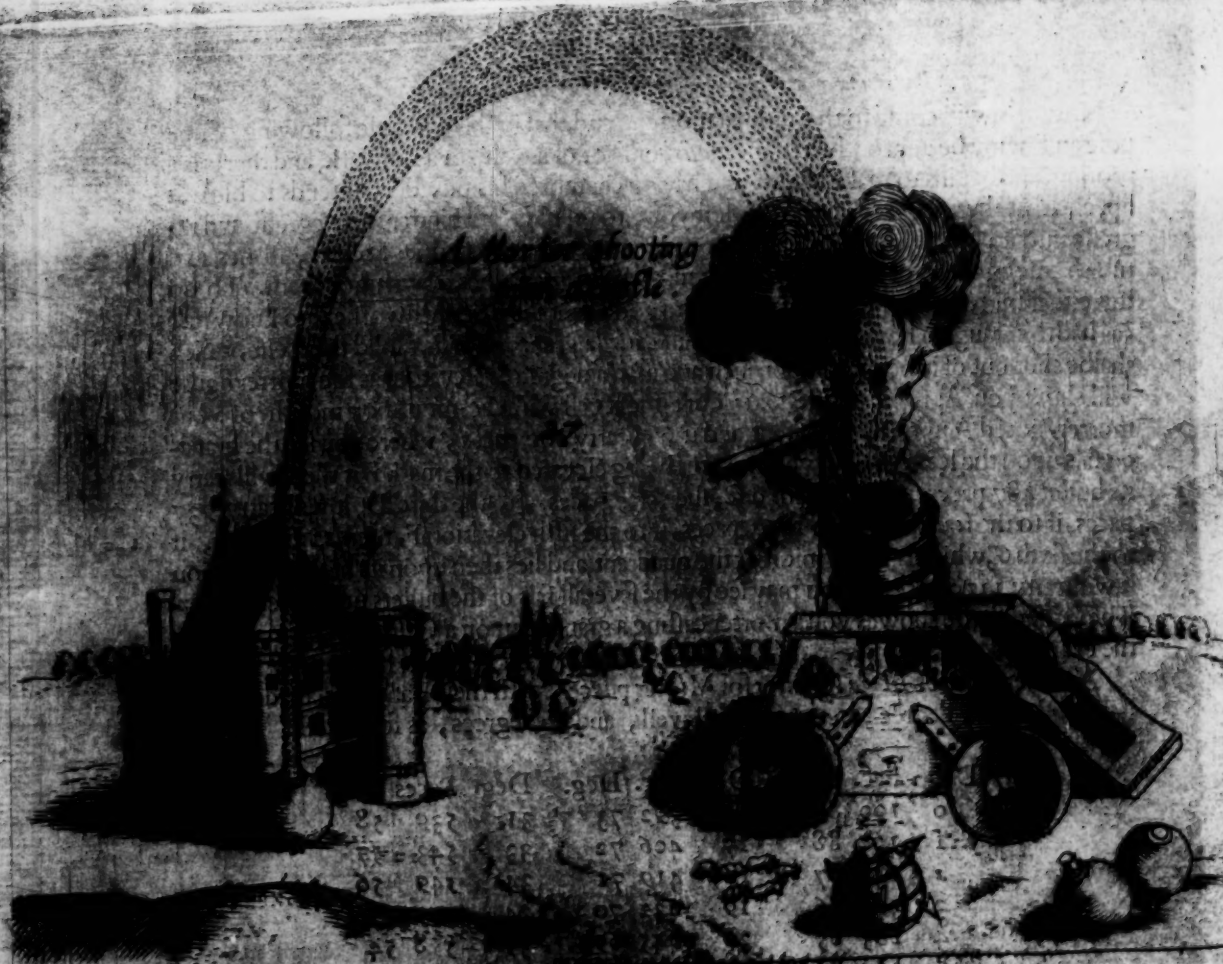


Now wee will come to the use of a mortar, and that in this example following, Suppose an Enemy be approached to the *Basir*, or foot of a wall, or a Bulwark, and there is a rooting, and begins to make a mine, and having chambered his powder, intends to blow it up, and that there is no other meanes left you, to repulse, and hinder their egress and regress into it: but by shooting out of your morters some Granadoes firebals, stones and rubbish among them, or at least by casting many hand-granadoes down upon them. To do this either by force or policy, it behoveth a good canonier, or fire-worker, to know first (as hath bin taught) how far his mortar will carry a granado, or any solid thing else, which shalbe shot out of it, being set upon such and such a degree & elevation as the mortar figure will show you. As for example, take your aime levell with the mould or mouth of your mortar, noted A upon the quadrant, and it will carry 200 paces, where you see the granado falls upon the letter A. but your mortar being elevated to the mark B it then will carry its bullet 487 paces, if to the second C, then 755 paces, if to the third D, it will carry 937 paces, if to the fourth E, then 1065 paces, if to the fifth elevation F, then 1132 paces, if to the sixth G, which is in the midst of the quadrant, and lies then upon its highest elevation it will carry 1170 paces, as you may see by the severall falls of the bullets upon every letter. The second figure shewes you a mortar casting a granado upon a Castle, as you may see by the example.

Another table of *Diego Vffanus* for Morter peeces, with their Randoms, made for every degree, between the levell, and 90 degrees, as followeth.

Degr.	Pac.	Deg.	Degr.	Pac.	Deg.	Degr.	Paces	Deg.
0	100	89	16	392	73	31	539	58
1	122	88	17	406	72	33	543	57
2	143	87	18	419	71	34	549	56
3	164	86	19	432	70	34	552	55
4	185	85	20	445	69	35	558	54
5	204	84	21	457	68	36	562	53
6	224	83	22	468	67	37	568	52
7	243	82	23	479	66	38	573	51
8	262	81	24	490	65	39	477	50
9	280	80	25	500	64	40	580	49
10	297	79	26	510	63	41	582	48
11	314	78	27	518	62	42	583	47
12	331	77	28	524	61	43	584	46
13	347	76	29	526	60	44	582	
14	363	75	30	534	59	45	582	
15	377	74						

*The*



# TREATING OF COMPOSITIONS, MIXTURES AND INGREDIENCES FOR THE MAKING OF YOVR

Concaue, or hollow *GRANADOES*, both great and small, to be shot, or cast out of a Morter, and also of your *HAND-GRANADOES*, to be cast into a Trench, a Sapp, or the worke of an Enemy.

## The Eleventh Chapter.

**F**irst, take three parts of Canon powder well pounded, and sifted, one third part of Greesh pitch, & halfe the weight thereof in brimstone, mingle these two lightly together, and then add to them a half part of ordinary salt, and afterwards knead them well together, with oyle of linseed. This done, fill the pipe of a Calu, with some of this paste, and commixture for a tryall of it: if it carries the flame cleare and faire, and blowes out of the pipe, with an offensive force, without cleaving to the pipe, into which it was put, then without all question it is a signe and token of the goodnesse and perfection thereof.

Now to charge a granado for your Morter or Bombard with this mixture, and ingredience: first you must take a round stick, to turn them about withall, of the bignes that it may go iust into the touch-hole of your granado, which you are to charge by reaching down to the very bottome of it, and giue it a stamp or two with the said stick, continuing so, filling and stamping it, untill you haue filled up the concaue of your granado up to the touch-hole of it within three or foure fingers breadth, then put into the pipe, or hole of your granado, an artificiall match, and fill it up round about the match, with the aforesaid Ingrediences even up to the very top of it, which you may do with your finger, without the help of the stick, because the match will stand bolt upright in the hole, and in the very midst of it. Lastly take a peece of course linnen cloth and smear it over with pitch and waxe well melted together, and lay it over the mouth of your touch-hole, in such sort, that the upper end of your match may peepe up a little through a small hole, made in your cloth, and then you must bind it hard about, by making your cloth fast to the mouth of the Morter.

There are diuers other receipts, both for the making of your Compositions, for great and small Granadoes, much differing one from the other, but of all others, this aboue is of excellent vse, and therefore it is needlesse for me to spend more time in the further search and discription of them: onely remember this for a generall rule, that in all compositions, mixtures, and ingrediences, they must all be well dryed, pounded, and pulverized, but for your great morters, it will suffice if they be lightly broken, the fall, breaking, and operation of them, are able to teare, rend, and breake downe houses in peeces. The figures of the granadoes are marked A B C vnder the Morter figure.

The same ingrediences will serue also for your hand-granadoes if they be finely dryed, pounded and pulverized, as is aboue said, and thus much for your Bombards Morters and granadoes both great and small.



**TREATING OF A PETTARD, WHICH IS A KIND OF A**  
short peece of Ordnance, devised of late yeares, for the blowing open of Gates, Ports  
and breaking down of draw-bridges, Their making, use, and manner of  
charging are here described.

The eleventh Chapter.

**T**HE Modell or forme of a pettard, represented unto you in the next plate and figure, is not much unlike to a Grocers, or an Apothecaries Spice-morter, and some are tapered much like a Coopers payle, litle deeper then the Dyamirer of their mouthes but being not above 1 in dyamitre at their bottome, or breech of their mouthes calibre, and in thicknesse of mettell; of the Dyamitre at their breech, and lessening by degrees in thickness towards their mouthes, Their magnitudes are some to hold but one pound of powder, or lesse, and others to hold 50 pound or more, and they vsually allow foure pound of brasse, or five pound of yron, to cast a pettard for one pound of powder, and two hundred 50 pound of brasse, or 3 hundred pound for a pettard that shall hold fifty pound of powder, using those proportions diminished for lesser, and augmented for greater, as Mr Norton in his praetize of Artillery describeth.

The demonstration thereof out of Diego Vffano,

Being masse and heauie (whereof the figure A is the mouth, B the breech neere the touch-hole) it must be carried upon a thick-board or planck, marked EE; and then layd upon a Karr noted C D, which serues not only for the use of it, but also to raise it, when you are to hang and fasten it upon a Port. This planchier in the midst, hath a round hole in it marked H, through which the nose, or mouth of your pettard is enchaesed. Aboue it there are two yron rings to hang it on to two Crochets marked G screwed fast into the port marked A with a match to giue fire unto it. A A are the Bungs, or tampkins wherewith the mouth of the Pettard is bunged up or stopped.

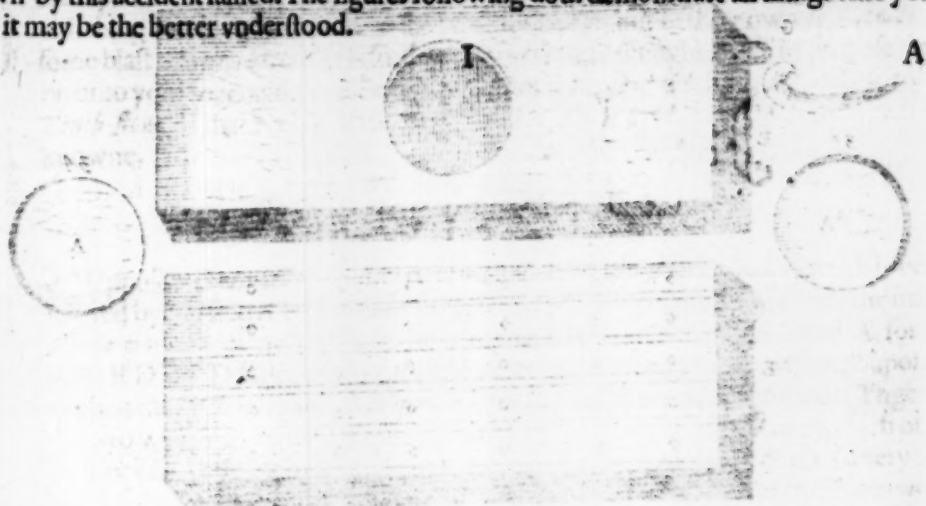
The outside on which the planchier is enchaesed being three inches thicke is even and plaine, armed with strong plates of yron to defend it from splitting: it is also to be underpropped with the forked rest, and stayed in the ground at the hinder end to keepe it from recoyling.

When you charge your pettard, you put a round stick into the very midst of the mouth of it down to the bottome, about the length of halfe a cube and some two fingers in circumference, & put no more into it at a time, then the better part of a pound of fine come powder, and so fill it litle and litle, stamping it well in, round about the said stick, with yron drifts or wodden stampers within the concue of the Pettard, vntill it be filled within one fingers breadth of the top and haue its due charge, then turne your stick in the midst about draw it out gently and fill up the hole out of which you draw the sticke with fine powder that when you are to giue fire at the touch-hole, the whole charge within may be fired in the twinkling of an eye, And haing thus giuen it the full charge, then stop the mouth of it close with the bung or tampkin noted A, which must be of the thicknesse of your litle finger, and lastly couer the mouth thereof with a thick waxed cloath, and power melted waxe vpon it some two fingers thick aboue the tampkin, & thus much for the charging of a pettard.

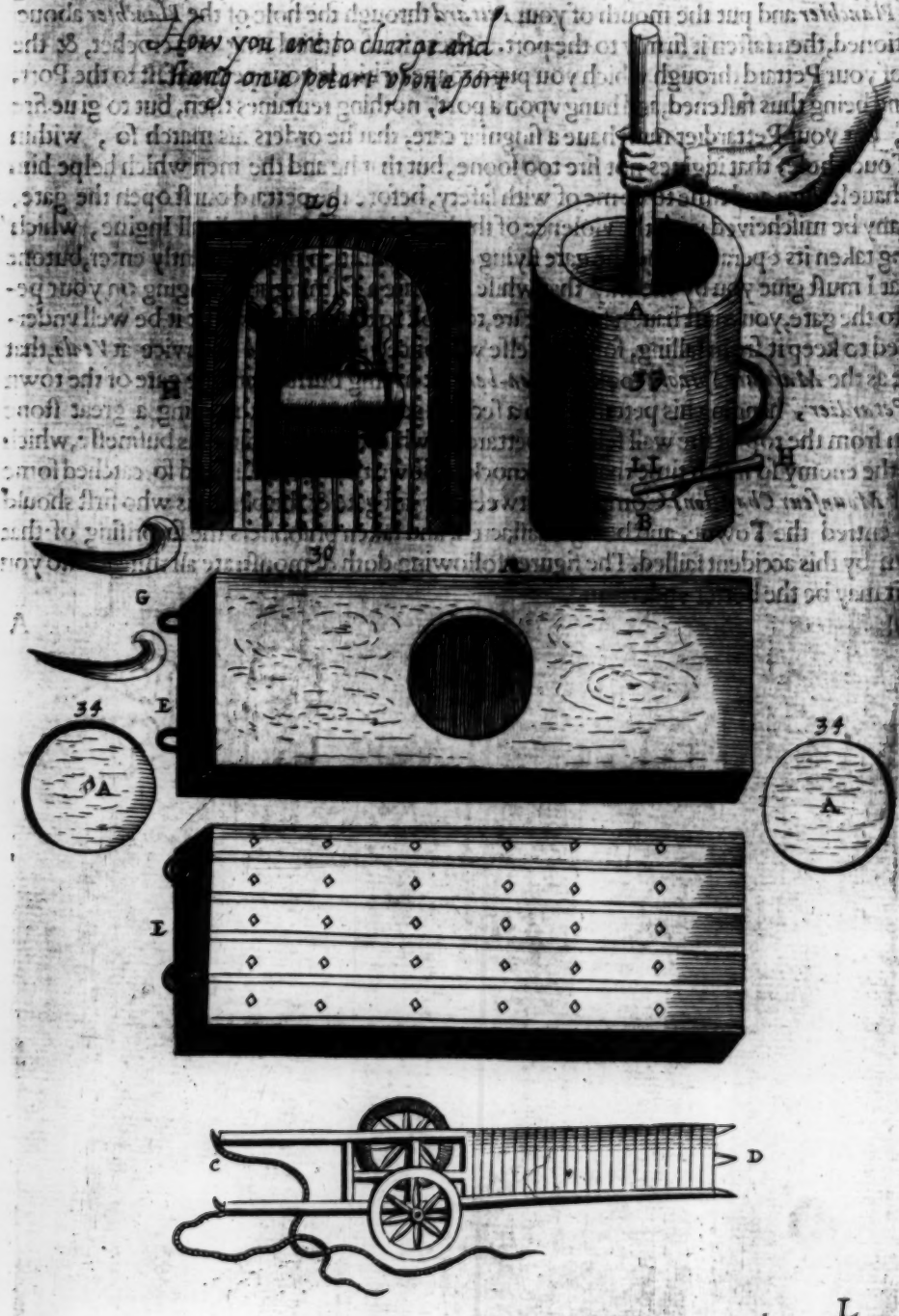
Now

Now we come to the fastning and hanging it on a Gate, to do this well, you must first scue in fast into the gate the Crochets marked G, & make choice as neer as you can of the weakest place of the Gate or Port, where it may easiliest be broken open, upon this hang your *Planchier* and put the mouth of your *Pettard* through the hole of the *Planchier* above mentioned, then fasten it firmly to the port. There is also a third ring or a crochet, & the care of your *Pettard* through which you put a roape to binde your *Pettard* fast to the Port.

And being thus fastened, and hung vpon a port, nothing remains then, but to giue fire to it, but your *Pettardier* must haue a singular care, that he orders his march so, within the Touch hole, that it giues not fire too soone, but that he and the men which helpe him may haue leasure and time to come of with safety, before the *Pettard* burst open the gate, least any be mischeived with the violence of the breaking of this diabolicall Engine, which hauing taken its operation, and the gate flying open, your men must presently enter, but one Caviat I must giue you by the way that while they are a fastning and hanging on your *Pettard*, to the gate, you must haue a special care, to look to the perculles, that it be well vnderproped to keep it from falling, for I my selfe was once vpon a peece of service at *Vanlo*, that yeere as the *Marquis Spinola* took in *Rien-berg*, & hauing burst open one gate of the town the *Pettardier*, hanging his *Pettard* vpon a second gate, a woman throwing a great stone down from the top of the wall feld the *Pettardier* while he was a doing his busnesse, which gaue the enemy so much time that they knocked down their perculis, and so caught some 30 of *Monsieur Chastilons* Company between the last gate & the perculis who first should haue entred the Towne, and being massacred, and taken prisoners the surprising of that Town by this accident failled. The figures following doth demonstrate all things vnto you that it may be the better vnderstood.



Now we come to the filling and hanging it on a Cart, to do this well, you must first  
 turn it into the gate the sockets marked G, & make holes as near as you can to the  
 weakest place of the Gate or Post, where it may easily be broken open upon this hanging  
 your Machine and put the mouth of your Machine through the hole of the Gate, & the  
 mentioned, then turn it into the post. *How you are to charge and*  
 end of your Post and though you put a new one in, you must not give it  
 And being thus filled, hanging upon a post, nothing remains but to give it  
 to it, & your Machine is in a manner ready, but he orders it much so, which  
 the Town, & that is, the too loose, but it is in the men which helps the  
 may be made, & the one of with which, before, & that is, the one which helps the  
 last may be made, & the one of with which, before, & that is, the one which helps the  
 having taken its place, & the one of with which, before, & that is, the one which helps the  
 Great I must give you, & the one of with which, before, & that is, the one which helps the  
 and to the gate you must give you, & the one of with which, before, & that is, the one which helps the  
 proper to keep it, & the one of with which, before, & that is, the one which helps the  
 year is the same, & the one of with which, before, & that is, the one which helps the  
 the Machine, & the one of with which, before, & that is, the one which helps the  
 down from the top, & the one of with which, before, & that is, the one which helps the  
 guard the enemy, & the one of with which, before, & that is, the one which helps the  
 so of Machine, & the one of with which, before, & that is, the one which helps the  
 hand, & the one of with which, before, & that is, the one which helps the  
 town by his accident called. The name following don't, & the one of with which, before, & that is, the one which helps the  
 that may be the

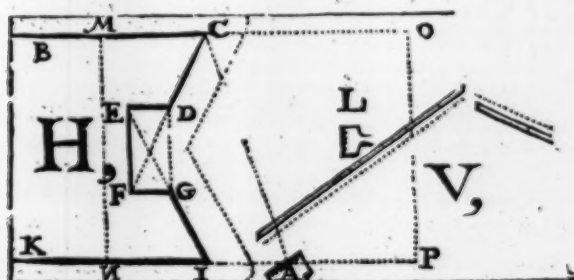




A  
**QUESTION PROPOUNDED TO THE BATAVIAN INGINIERS**  
 By Master **JOHN BAPTISTA** Mathematician of **ANTWERP**  
 For the battering of a **HORNE-WORKE.**

*According to the Proverb.  
 Let skill appeare by good Demonstration.*

AND  
 Dissolved, and Resolved by that famous Mathematician Master  
**JOHN STAMPION** of the Hagh in Holland.



The report (**INGENIOVS BATAVIANS**) of some of your vnskilfulnesse, hath spread it selfe farre abroad, and flowne I know not into what country, and yet no speciall thing is come to the view of the world, whether out of your own *self-conceit*, or from some blast of *Superbetie*. It is so, that I my selfe haue thought good, to propose this Question unto your ingenuitie as a Touchstone, that it may be dissolved, according to the true *Touch-stone* of that Noble Science of the **MATHEMATICKS** by which it may be knowne.

*The Proposition is this.*

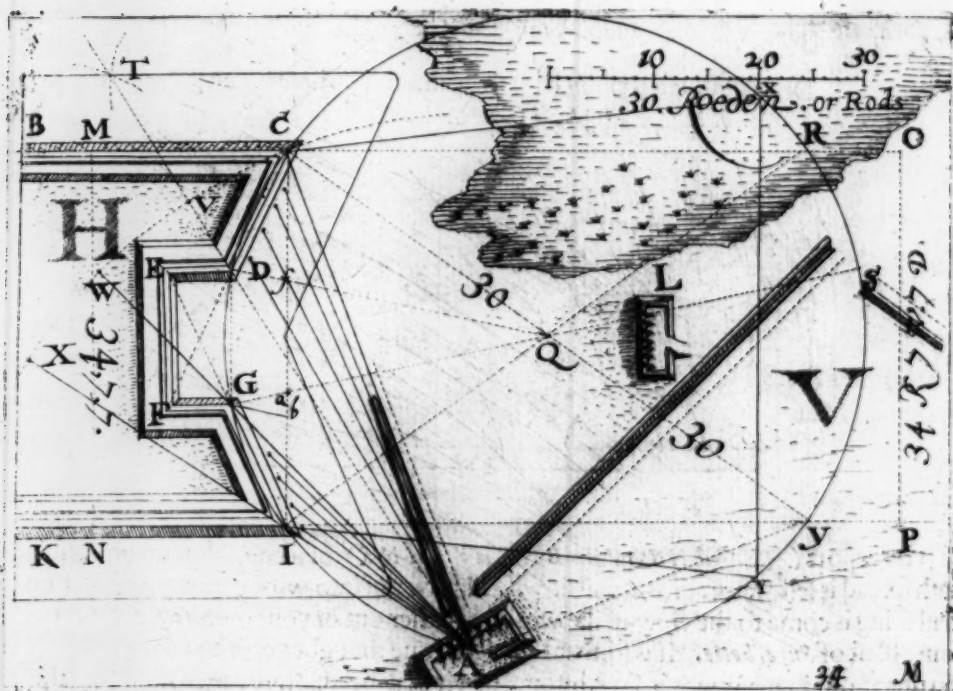
**S**uppose a Generall, having approached to a certain *Horne-work*, which is here decy-  
 fired by the Letter **H**, and hath come with his line (or sapp) neere unto the moat of this  
*Horne-work*, and there desires to cast up a royall battery in the place noted **A**, for to flank  
 upon **E D** and **D C**, in such sort, that the force of the Canon may beat aswell upon the *Face*  
 as upon the *Flanck*, to wit, (*Proportio Equalis*) by an equall proportion. Together, that  
 the two wings **C D** and **G J**, and the distance **G D**, which are all alike to each other, may  
 be flanked with the lines and blowes, yet so, as the distance of the battery **A**, to the  
 point **C** be no more then 60 rodd, or 600 foote, and the bredth of the Horn-work to be  
 as **M N** or **O P** and being measured is found to be 34 Rodd 7 foote and 7 inches. The  
 question is how this must be wrought.

Moreover of the same Horn-work the Face is as much as the two greatest valuation of  
 1 ather **a a a a a a a a a a**, 875 **a a a a a**, 3470 **a a a a**, 20640 **a a**, 104040 **a**, are alike to  
 5 **a a a a a a a a** 1147 **a a a a a a a a** 28182 **a a a a** 118800, & the distance **A C** no further then 900  
 foot **O A** and the rest of the conditions as abouesaid. The question is to find out the bredth  
 of the Horn-work and also the other parts as is aboue said.

K

The

THE MATHEMATICALL DESSOLVTION VPON THIS  
Antwerpian question, Dedicated to all the Lovers of that noble Science, by Master  
*John Stampion de Jonge Mathematician.*



Sirs The wing of Fame hath of late nattered out, That new our ingenuity is brought to the tryall of the Touchstone by proposing of a certain question under the name of Senor *John Baptista* of Antwerp, whose pate is swolne with selfe conceitednesse and pride, which being not worthy the answering, I wil come to the Solution of it, rather to giue satisfaction to our Batavians, then to fulfill the desire of the Propounder. And this may serue as an introduction unto it; to the end, that the honor, which he doth assume unto himselfe, may not wholly be appropriated unto himself.

The Dessolution.

Let this figure aboue of a Hornework (as he saith) be decyfered by H, whose bredth MN is known to be 34 Rods, 7 foot, and 7 inches, & the required battery noted A, whose place is likewise found out by the known conditions. The first condition is, that the violence of the Canon planted upon the battery A, beates with as much force upon the flank ED, as it doth upon the face CD, whence it is manifest, that the angle of the *espaule*, or shoulder EDC, being devided into two equal parts with the right line TVDA, that then this battery of necessity must come to be in the right line TDA. Secondly that the face DC, & JG, and the distance DG, may with the like Canon shot be flankted and beaten upon from the batterie A, that is, when as the Angles IAG, GAD, DAC, are alike one to the other, whence will follow, that through the five points CDGI and A, a circular circumference will passe. Now for that which concernes the third known part, namely as that the battery A must be no further from C then sixty rodd, or sixe hundred foote, a being the greatest distance in the circumference as is in the third boock and 15 proposition which is taken from of the middle-line of Euclids propositions, we haue found out according

ding to this preparation, the middle line as *CY* to be sixty rodde, the right-line *CJ* to be 34 rodde 7 foote & 7 inches, or 34 <sup>11</sup>/<sub>12</sub> and the lines *JG*, *GD*, & *DC*, to be answerable one to another. Let *G*. now be the *Center*, then substraſt *IG*. and *QD* cutting through *CI* in *a*, and *f*, then will *Ja* or *IC* be alike to one of the lines *IG* &c: becauſe now *QI* ſtands alike to *IG* as *IG*, is alike to *Ga* and by the 4th propoſition of the 6th book, as *Qa* is alike to *aſ*, ſo alſo *QG* is to *GD*, or as *IG* is to *GA* the cube vpon *IG*, with the corps which is made vpon the quadrate *IQ*, as *ſuperſicies*, & the depth *IC* are together alike the corps, which is made vpon the quadrate *IQ* as *ſuperſicies*, and the depth *IC* are together alike to the corps vpon the quadrate *IQ*, as *ſuperſicies*, and the depth to be three times the length of *IG*. Whence will follow, alwell by the corporall cutting of a dye, as we haue ſhown in our new *Algebra* which ſhall ſhortly God willing come out in Engliſh as by *Sectione Com.* by which *IG* is found to make 28 <sup>1</sup>/<sub>2</sub> —  $\sqrt{263}$  : ſo doth *EF*, or *DC* likewise, and laſtly the angle *EDC*, being devided into two equall parts by the prececedent *TD* then you haue the cutting of *A* in the circumference out of *Q* where your batterie is to be caſt up.

Now whereas Mr *Stampton* hath not expreſſed the finding out of the Face *G.I.* by reaſon of the little ſpace contained therein; the more becauſe he hath fully ſhown the deſolution therof in his New *Algebra*, we will here demonſtrate the whole working thereof, how the face *GI* by his new *Algebra* annexed here unto is to be found out.

The operation.

Setting downe for *GJ*. *x* ſo comes  $xxx + 31293$  alike to  $2700x$ , or  $xxx - 2700x$  like to  $-31293$ . which is an equality in the third caſe of the *Algebra* of Mr *John Stampion*, which being changed by the ſecond caſe comes to be  $xxx - 2700x$  as  $3129$  is alike. out of this vacant number  $31293$  is extracted a Cubice-roote,  $2700$  times, the ſide as Mr *Stampion* teacheth in his New *Algebra* pag. 112 & 113 comes the valuation of  $x57$  whereof the whole working ſhall here be ſet downe as followeth.

The finding of the firſt letter.

$\begin{array}{r} 3x \mid x57 \\ \hline xxx \\ \hline 4xxx57 \end{array}$	57.	$\begin{array}{r} 5. \\ 5. \\ \hline 25. \\ 5. \\ \hline 125. \\ 13500. \\ \hline -1000. \end{array}$	The firſt Subſtraction.
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*The principles of the Art Militarij*  
The finding out of the second letters

$$\begin{array}{r}
 5 \text{ ————— } 25 \\
 3 \text{ ————— } 3 \\
 \hline
 15 \qquad 75 \\
 \qquad 2700 \\
 \hline
 4800 \\
 7 \text{ the second letter.} \\
 \hline
 135 \qquad 33600 \\
 60 \qquad 735 \\
 \hline
 705 \qquad 41343 \\
 \hline
 41343 \text{ the last Subtraction.}
 \end{array}$$

$$\begin{array}{r}
 4193 \\
 4800 \quad [7 \\
 \hline
 \text{the divider.}
 \end{array}$$

This 57 is now the valuation of  $x$ , as  $xxx \ 2700 \ x$  is like to  $31293$  for the same value the signe — set down commeth 57, for the least valuation of the equality then in  $xxx - 2700 \ x$  is alike to  $31291$ . Now to find out by this 57 the length of the face  $GI$ , as followeth in the Rule fol 138 of his new Algebra, that is, taking the half of 57, which is  $28\frac{1}{2}$  and multiply the same quadrate, and the product will be  $812\frac{1}{4}$ , whose tripple is  $2436\frac{1}{4}$  which being subtracted out of 2700, the number  $x$  remains  $263\frac{1}{4}$  whose square root is  $\sqrt{263}$  which being deducted from the halfe of 57, as being  $28\frac{1}{2}$  there remains  $28\frac{1}{2} - \sqrt{263}$  for the length of the face  $GI$ , and  $EF$ , &  $DC$  doth as much also.

observe the manner of the operation.

$$\begin{array}{r}
 47 \\
 .]28\frac{1}{2} \\
 \underline{28} \\
 224\frac{1}{2} \\
 \underline{56} \\
 28 \\
 812\frac{1}{4} \\
 \underline{3} \\
 2436\frac{1}{4}
 \end{array}$$

$$\begin{array}{r}
 2700 \\
 2336 \\
 \hline
 263
 \end{array}$$

comes to be  $28 - 263$

for  $GI$ .

## CHAPTER IX.

*Generall.* **H**AVING brought your Approaches neere unto a Towre, or a Fortresse, whether would you choose a Bulwarke or a Curtaine to be battered with your Ordnance?

*Captaine.* A Towne may be assaulted in divers places, sometimes you assault one side, when as you make your Batterie on an other, Sometimes you choose a Bulwarke, otherwhiles a Curtaine to be battered, with this intention, to take in the Towne, as soone as possible may bee. As for mee, if I were to take in a great Towne which is populous, I had rather choose to batter a Curtaine, then a Bulwarke, which hath a high catt, or mount upon it: especially, seeing that in great Townes the Bulwarkes lying one far from an other, they doe show the skirt of the Curtaine very open.

*Gen.* Why would you rather choose a Curtaine then a Bulwarke?

*Capt.* Because your Bulwarkes are alwaies stronger, and better fortified then your Curtaine, and being as it is the principall strength of a place, and better furnished with platformes, flankes, &c. will require more time, labour, and charge to batter then your Curtaine.

*Gen.* But what Generall is so ill experienced, as to labour to batter a Curtaine, having two strong Bulwarkes on both sides of him, to flanker him when hee is to put over his Gallerie, and to giue an assault upon the Curtaine: peradventure for his labour and paines, hee may bee well beaten.

*Capt.* Soft ( Good Sir, ) Suppose that after a great deale of labour and paines you haue battered a Bulwarke, and falling up to the breach to assault it, you finde it cut off, and an Enemy lodged in it, must you not then beginne to sap forward againe, to make a new batterie, whereas on a Curtaine there is not that meanes of cutting it off, as upon a large Bulwarke.

*Gen.* Haue you ever seene the experience of it?

*Capt.* Yes Sir, the Prince of Orange tooke in the Bosch by a Bulwarke, and also Breda, but Maffrick was taken in by making a breach, and springing of a mine, upon the Curtaine betweene Jonger Tort and a bulwarke, howsoever the Towne of Cortes upon the frontiers of France, was first battered by the Arch- duke of Austria upon the point of a Bulwarke, neere unto the very ioynt of the Curtaine, where a high, and a strong turret stood, which did annoy us much, so that we could not advance forward, but were constrained to leaue off our approach on that side, and began to make a new Batterie for a breach in a Curtaine on the Feild-side, where there lay a strong Bulwarke to defend it which did our men a great deale of harme, but howsoever with great difficulty and much adoe, wee tooke in the Towne that way, by lodging our selues in the Curtaine. Likewise the city of Cambray was battered, and taken in upon a Curtaine, for all there were two strong Bulwarks that flankered it, which if wee had runne our line upon a Bulwarke, we should not haue forced it so soone, yea such an occasion might present it selfe, that a Generall may be forced to batter both the one and the other, or to finde out some secret way by undermining a wall, and blowing it up with powder.

*Gen.* This is for your great Townes, but what say you to a Castle, a Cittadel, or some narrow Fortresse, how will you goe to worke to take in those with the best advantage.

*Capt.* As for your Forts, and Castles, it is much better to batter them upon a mount or a Bulwarke, then upon a Curtaine: my reason is this, that in these your Bulwarkes lying close one by an other, will flanke one an other with the greater force, and hide the Curtaine much better too defend it, so that one cannot so easily force it, if the said defenses be not taken away.

*Gen.* Goe to then; a Towne then being to be battered, either upon a Curtaine or a Bulwarke how many peeces of Ordnance would you haue to doe it, and, how and in what manner would you place, and plant your Ordnance upon your batteries to make a good breach?

*Capt.* To effect this, I would haue 18 peeces of canon and halfe canon, (for lesser peeces for batterie are now growne out of use).

*Gen.* Whether would you choose more whole canon or halfe canon?

*Capt.* To batter a place well either upon a stony or a Earthy wall, you may assure your selfe,

the more whole canon you haue, the greater and the more sufficient your breach will be: for your great battering peeces doe spoile, and beate downe any thing, which doth meete with their great force and violence: *howsoever of late yeares experience hath taught at diuers sieges, that your halfe Canon which are more portable, having good store of them, will doe the businesse as well as your whole canon.*

*Gen.* But at what distance would you make your batteries, for these 18 peeces of Canon, and how neere unto the place, which you intend to batter.

*Capt.* I would counsell a Generall to approach as neere unto that place as possible may bee, and make his batteries some two or three hundred paces one from an other, and that if it were possible to advance covertly the Approach and sap, even up to the Counter-scharfe, and very brinke of the moate, to prepare a way for his Gallerie: not onely to batter that place being at hand with the greater force, but also to keepe in, and hinder an Enemie from Sallying out upon the besiegers, to discover and dismount their Ordnance in *Casemates*, or if they haue sunke any in their walles or False-bray, and so to terrifie them, that they dare not stirre out.

*Gen.* I am also of your opinion, and hold it for good, yet I feare this will not be so soon done, and is sooner spoken, then executed, and that before you can bring your approach and sapp so far it will cost you warme blood, and a great many mens liues, if you haue a stout Enemie within to deale withall, and one that is very Vigilant, and carefull to stand upon his Guard, and his defence.

*Capt.* Tis true, this cannot bee done without danger, and the losse of men, but hee that is fearefull must stay at home, and not come into the warres where there is neither place nor time, which doth free or exempt him from danger: yet the danger is not alwaies so great, especially in such places, where you haue Earth enough to worke with, to cast up your sapps, and to heighthen and deepen your Approaches, which will show you the way, for the more higher you finde the ground in Approching to the edge of the moate, the deeper trenches you may make and cover your selfe by casting up of blinds continually, to keepe you from the sight of the besieged, and it is better when you haue brought your approach as it were under them, then if you were 200 or 300 paces distant from them.

*Gen.* I pray you Good Sir, how would you plant, and deuide these 18 peeces of Canon?

*Capt.* I would make a great batterie with 8 of them to beate upon a right line, either upon a Curtaine or the point of a Bulwarke (which the Generall shall finde fittest) Two batteries with each 3 Canon to play slope-wise from the great batterie as the ninth plate and 28 & 29 figures shewes, and two batteries, with two halfe Canon a peece to play, as it were cross-wise upon the breach, and thus you see your 18 peeces planted upon 5 bateries, as you may obserue in the 9<sup>th</sup> plate and the two figures of a Curtaine and of a Bulwarke following.

*Gen.* Good Sir tell mee I pray you how many shot will these 18 peeces of Canon make in 10 howers, and how much powder will they require.

*Capt.* In 10 howres they may make some 1500 shott, and will require a matter of 25000 pound weight of powder, that is 150 barrells full, each barrell containning 160 pound weight in it.

*Gen.* You make your account then that every peece in the space of 10 howers is to shoot 80 shot, that is 8 shot an hower for every peece.

*Capt.* You may make 10 shot in an howre if you please, if your peeces be reinforced, but as for your ordinary peeces, they haue not mettalline substance enough to beare it: considering also that after you haue made 40 shot out of a peece, it will be so heated, that it must haue a cooling time, which must bee at least an hower, for otherwise your peece being growne over hot, it may cause danger.

*Gen.* Me thinks that 80 shot for a peece in so long a time were too little, having often heard, that in that while, a peece may well be shot of 130 times, can you giue me your resolution upon this?

*Capt.* I will tell you Sir what hapned once in the Island of Bomble Anno 1599. wee planted a peece by a mill, by which wee did annoy the Enemie very much, so that they were forced to make



make a battery, and planted a whole Canon and a demy-Canon upon it, seeking to dismount ours. Now shooting with this peece from foure of the clock in the morning, till eleven toward noone, this peece had a cooling time the space of two howers, and about one of the clock, wee began to play with it againe, and continued shooting with it till 4 a clock in the afternoone: but this peece being not able to endure the force and heating of so many shot, wee were constrained to leaue off with it: and yet ceased not shooting with our other peeces from an other batterie by commaund from *Don Lewes de Valasco* Generall of our Ordnance, and shooting crossewise with some other of our peeces, wee put the Enemies two peeces to silence in the space of an hower, a Souldier of ours standing by, was curious to keepe a taily of the number of all the shot we made from the morning till foure a clock in the afternoone, and showed mee 80 notches, which deducting the two howers cooling, our peece planted at the mill made 8 shot in an hower, which was as much as could be required of it.

*Senior Diego Vffano* giue your Translatour leaue to interrupt you a little, and so to conclude this discourse. If you remember at the siege of Ostend which you mention often in your Chapters and dialogues, you were without, and I was within the Towne, that on the seventh of January Anno 1602. *Stilo Novo*, After Sir Francis Vere of famous memory (who defended and kept the Towne against you) had deluded you with a Parley, onely to gaine time, and to make up our Canon and Sea-beaten workes, along the skirt of the old Towne, his highnesse the Archduke resolved to assault us, and that morning began to batter Sand-hill and Schotenburgh, to make a breach for you against that night, with intent to Assault us (as you did) and to haue entred the Towne, and haue put us all to the sword, the Relation whereof you shall heare, in the end of this booke. Now you had placed and planted your 20 peeces of Canon to batter them in this manner, 8 from your batterie at the foote of the downes, 8 from a batterie on the right hand of the downes, 6 from your pile batterie, 6 more which you had made upon the sand, and as it were raised out of the sea: the first shot upon the breach in a right line, and the other 2 sloopewise, as your two figures following doe demonstrate. These 20 peeces of Canon towards noone had a cooling time, for a matter of some 2 howers, just as you haue said, and afterward you began to batter the breach and old Towne againe, till it was almost twilight, and then they cooled againe, till you were readie to giue us an assault, and before you fell on as I doe well remember, you shot of one of your Canons with a hollow bullet which flew over the Towne and made a great humming noise, as a warning peece to the Count of Bucquoy, who lay on the East side, that you were then ready to fall on, and that he should doe the like, this was your Signall. Now Generall Vere knowing well your intent, gaue order to the Gentleman of our Ordnance who had the guard upon Sandhill, that hee should keepe a true taily and an account of all the shot you made that day, with your 20 peeces of Canon upon the breach & the old Towne, which being cast up, there were found to be made that day from morning till night 2200 shot, which was found to be an 110 shot for every peece, & 11 shot an houre for every peece, which is more then 8, but I verely beleue your peeces were renforced. This by the way, and so I returne againe to your owne dialogue.

*Gen.* (Good Sir) I pray you show mee how you would batter the point of a Bulwarke (as the figure 28 following demonstrates,) and giue mee some reasons aswell defensiue as offensiue.

*Capt.* I am willing to giue your Lordship content, and say, If I were to batter the point of a Bulwarke or a Bastion, I would haue the same number of battering Canon, and planted in the same forme & manner as they were for the Curtaine and to shoot sloopewise and crossewise also, & if your approaches were advanced so farre they should be planted upon the very brinke of the moate and upon the *Counterscharfe*, I would plant 4 of them so, that they should dismount the Enemies Canon in their *Casemates*, or any if they had sunk them in their *Falsébray* which should waite upon that occasion.

*Gen.* I am of your mind and preferre such a battery before all others, who are of the opinion that they had rather choose a Curtaine then a Bulwarke to be battered.

*Capt.* You haue heard my reasons for that, and see the figures following traced out to you. But as for your Bulwark the besieged may cut it off (as you may mark in the figures of *retréchements* and *Cuttings off* in the second part of this booke) for indeed it will be a hard matter to force an Enemy out of a Bulwark, who is resolved to loofe it by peecemale and degrees and there is not so

much danger in assaulting of a *Curtaine*, which being once well battered and beaten downe with your Ordnance, you haue an easier way and entrance to fall on with your troupes of men, to enter the Towne, or Fortresse, but for the defence which is made from your *Flancking Bulwarkes*, or your *Casemates*, you must make batteries upon the brinke of the moate against them, (as is said) to dismount the Enemies peeces, and to flanker with your Ordnance the *Parapets* of the Bulwarks to beate them about their eares, that the bulwarkes may lie the more open to you, and I thinke this way is the least danger.

*Gen.* But the Besieged their cuttings off may they not be made, as well upon a *Curtaine* as upon a *Bulwarke*.

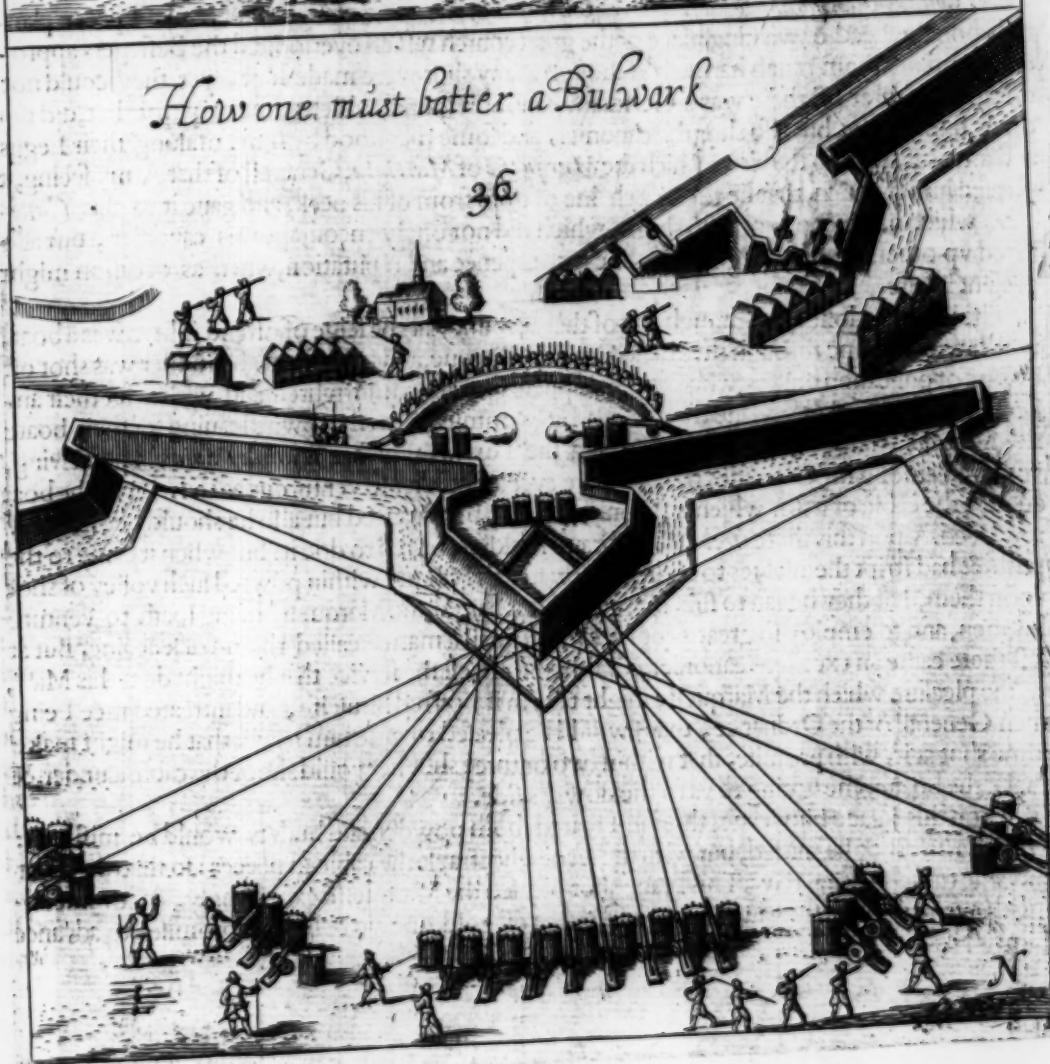
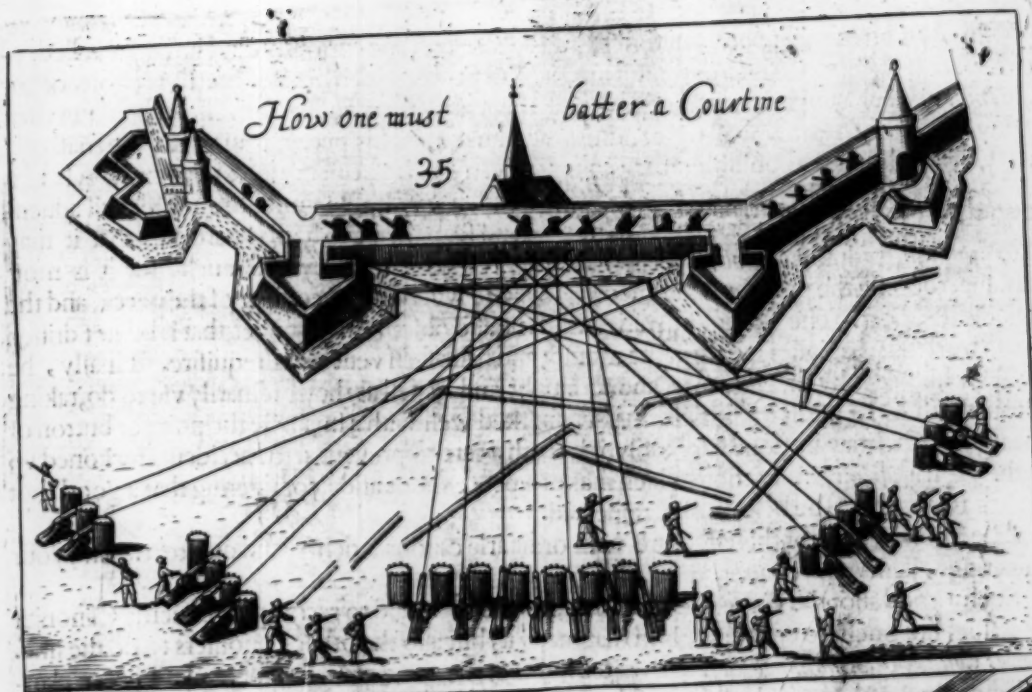
*Capt.* No, for the *Rampire* being thinner, you haue neither so much ground, nor the like accommodation in a *Curtaine* as in a *Bulwarke* and indeed, a Governour of a Towne, or of a Fortresse if he were put to his choise, had rather to bee assaulted on a Bulwarke (then on a Curtaine) by cutting it off into the forme of a halfe moone, that he might make a new resistance, and defend it with a lesse number of men. Besides, in a Bulwarke the Besieged haue this advantage over the *Affaillants*, which is very dangerous for them, that they may make a mine within the bowels of their Bulwarke when an enemy shall attempt to assault it, and thinking to cneer the Breach and take the Towne, they may be blowne up into the Aire by a Counter mine, the like also may happen to the Besieged, the *Affaillants*, springing their mine also in a Bulwarke, when they thinke they stand upon their best defence.

*Gen.* May not the like be done also in a Curtaine?

*Capt.* No, it will not take the like effect as in a Bulwarke, for a Breach being once made in a Curtaine, for as an enemy may assault it at large, so they may bring a greater number of men to fight, to helpe to defend it, whereas in a Bulwarke they are pend vp and straighted in a narrow place, which may be cut off, and will require a fewer number of men to defend it, whereas those which are to force it, must be constrained to bring vp a great many me to assault, who in an instant may be in danger of blowing vp.

*Gen.* Your reasons (Good Captaine) are not to bee slighted; but as for me, I hold it safer, to batter and assault the breach of a Bulwarke, then of a Curtaine. For though the besieged may cut it off, and defend it with a fewer number of men, yet the Assaulters haue this advantage over the Besieged defendants, that they haue more place and elbow roome, and may finde a lesse resistance then in a Curtaine, seeing that one may make as great a breach in a Bulwarke as in a Curtaine: because your Ordnance may beate it flat, and leuell with the ground, and choosung rather a Bulwarke: I will herewith conclude this discourse, and now shew you the figures both of the one, and of the other in this plate following.

HOW





HOW A CANONIER OUGHT TO GOVERNE  
himselfe in making of a good shott.

## CHAP. X.

**A**N Ocasion may happen sometimes, that a peece must be curiously, and iustly Levelled; especially, when one is to dismount an enemies peece, which lies in some secret port or *Casemate*, which may hinder and annoy the Besiegers of a towne, or Fortresse. It behooves then a good Gunner, to know well the condition and quality of his peece, having had the triall of it many times. For it is impossible, that a canonier can let him be neuer so expert, know what his peece will do before he hath had practize and experience of it. He must not shoote at all adventures, neither must he in charging of it, ramme and stop the powder too hard but that it may take fire in the twinkling of an eye, and that his peece may not recoyle to much, for it is most certaine, the lesse the powder is rammed in, the lesse will be the recoyling of the peece, and the easier is the shott. The like consideration must he also obserue in his bullet, that it be not driuen in too hard, but that it lies gently in the mould, and haue such vent as is requisite. Finally, he must lay his peece by the *Quadrant* about taught, and Leuell as they ordinarily vse to do, taking his aime iust in the midst of the frizes, having marked well with a small file the point or button of the sight, & this may be done very easily, if he hath a care to prevent all the accidents reckoned vp in the 9 Chapter; especially, those which makes a peece shoot aside, considering that a good shot makes a Canonier to be beloved and respected.

The fittest peeces for this effect are your ordinarie canons, demy, and quarter canon, your culverings, demy and quarter.

Such a good shot the General ought to take notice of, and to recompence such a Canonier liberallie, not onely to encourage him that made it, but also the other Canoniers to do the like. *Lewes Collade* in his *mannell* practize writeth, that at the seige of *Sienna* there was a peece planted vpon the Lead, or walking place of the great church which overlooked the Besiegers approaches, and did them much harme and though many shot were made at it, yet they could not dismount it till at last there was a Germaine canonier found, which at the very first shot, did not onely dismount it, but also shot the canonier, and some that stood by him, making their Leggs and armes fly vp into the aire. Which the *Marquesse of Martinia*, Generall of that Army seeing, it pleased him so much, that he tooke a chaine of gold from of his neck, and gaue it to this *Canonier*, which had made so braue a shoot, which did not onely encourage this canonier, but also stired vp others thereby to gaine the like recompence and reputation, when as occasion might present it selfe.

The like was done also (though not of that account) at the seige of ostend, There was a boat, which would come through the chanell into the Towne, and running in, the rudder was shot off by one of our canon bullets, whereat the shippers were much affrighted, and withall let their anker fall, and were glade to saue themselues by swimming into the towne leauing so their boate riding at an Anker betweene the dike and the Towne, which *Marques Spinola* perceiving, enquired among his Captaines if there were ever a Souldier so venturous as to swim to the boat and cut the cable of it, for which he should not only be advanced but also he should bee liberally rewarded. Vpon this there were many braue souldiers offred to doe it: but when it came to the push, & had stript themselues to go into the wai er, the enemy within powred such volley of shot vpon them, that they began to flinch & grow faint harted, the *Marquesse* being loath to venture his men, and to employ so great a courage for so small a matter, called them back againe. But at last there came an excellent canonier, considering aswell, the service that he might do to his Ma<sup>tie</sup>, as the pleasure which the *Marquesse* might take in it; offred himselfe, and intreated mee being then Generall of the Ordnance, that I would be pleased to giue him leaue, that he might make some shot at it, with promise, that within two or three shot he would shoot the cable asunder, & make the boat come floating to vs to the downes side.

Vpon this I gaue him leaue, though I feared, both powder, and bullets would be misspent: with the first shot he missed, but with the second he strack the cable in peeces: so that the boat indeede came floating to vs. This braue shot pleased the *Marquesse* exceedingly, & commending this canonier greatly, gaue him a good peece of gold, or two & besides promised to advance him.

It is true Senior Diego Vffano, your Translatour being then page unto Generall Francis Vere, who then commanded within this Towne, was then a spectatour of it, and Sir Francis Vere and divers Officers which looked on commended also your Canonier highly, for making so braue a shot, but I will put you in minde of two or three other, more famous then that. If you remember there lay a whole Canon of ours upon the West Bulwarke, which carried a bullet of 48 or 49 pound weight, and as it was a braue peece: so had it an excellent Canonier, one Francis Nelson an English man, who served Queen Elizabeth, of ever blessed memory in the Brill, he shooting so sure with it, that he dismounted 2 or 3 of your peeces which were planted upon your high Catt upon the downes, for a revenge you did make a batterie of 2 or 3 Canon to dismount our peece, and one of your Canoniers made so good a shot, that he shot his bullet iust into the very bore, or mouth of our Canon, ours being charged, your bullet and ours striking together in our Canon, from that violent blow, flew sparkes which gaue fire to some loose cornes of powder which were not well driven home, and so our peece giving fire to it selfe, sent you back your owne bullet, & ours to accompany it, without breaking or doing any harme to our peece, and this is most true for there are some Officers yet living that saw it.

The second was this, you had a halfe Canon that endeoured to dismount one of ours, which also sought to dismount yours, both Canoniers having levelled their peeces as right as possibly they could, and giving fire at an instant together your bullet and ours meeting one another in the Aire, with the violence of that encounter, both bullets breaking; the peeces of them flew up as high into the Aire as Pauls steeple. If Vandermyle the Contronler of the States Ordnance were alive, he could tell you that this strange shot is true, as well as I.

And now you are a discourfing, I will truly relate two, or three more unto you which came from your Catt. Some of our Run-wayes could tell you, and show you almost in what house Generall Vere lay in Ostend, and you had a shreud spight at him, for some daies you haue shot, 8 or 9 Canon shot through the vpper part of his Lodging, and one night amongst the rest, having bin the round, for he was very vigilant, and carefull to look to your proceedings, and by all meanes possible to hinder your approaches: comming home after Sun rising, when he knew there was no danger, he went to take his rest for 3 or 4 howers, and lay downe and slept upon his bed in an upper chamber, awaking he called for a cleane shirt, and while his footeman was ayding of it before a Charcoale fire in the chimney, while one that was then his page was a pulling a silke quilted waf-coate over his eares, and calling for the shirt to putt it over his head, his footeman comming with it, iust came a Canon bullet of 49 pound weight through a winechot Bedsted, iust by Sir Francis Vere and his Page, the Lacquey comming with the shirt, shot both the shirt, and his bowels to pash, which bloud light and spring on him and his page, was not this a narrow escape?

After this Sir Francis Vere would lie no more in this upper chamber, but remooved his own lodging to another lower roome, howsoever, from your high Catt or mount you could finde us out againe. For a while after Sir Francis Vere going every night the Round, and visiting the Gards without the Towne, to discover how you did advance your approaches, & to make you buy that ground full dearely: The Summe being up came home to take his wonted rest, till 10 a clock before noon, making the nights the dayes, and part of the day our night, for a resting time. The same page after Sir Francis Vere had called for him, came into his chamber, and having a little firkin standing by the hearth, in taking up a few charre-coale ashes into it, comes an other bullet of some 48 pound weight from your Catt, shootes through the utmost part of the chimney, a little about the mantletree, and the bullet having come through a good part of the forchouse, and being somewhat deaded, fals iust by the pages eares into the very firkin, which the page was, a putting the ashes into, brake it, and made a dint upon the hearth, all the ashes flying out, the page giving a leape toward his Masters bedd, for wee could scarce see one another, because the ashes made such a dust, and presently fell downe about 20 great brick-bats, which the bullet had loofened in the chimney upon his head, had he not leapt away, this was an other escape: But for a revenge the page got one of Sir Francis Veres centinels, that stood in the streete before his dore, to crue up this bullet in a wheele barrow up to the west Bulwarke, to the English Canonier before mentioned, and because you write in your former Dialogue, that one bullet may fitt the calibre or bore of another peece, this bullet fitted so iustly our Canon above mentioned to



a haire, which was sent going to you againe, piping hot out of our Canon, to your Catt; and hee made so good a shot, that I verely beleeeue, he sent some of you to *Purgatory*, for wee could discover some Armes and Legges which flew up into the Aire, and so you were payed with your owne coine.

One, or two more and then I haue done. You remember well the 7<sup>th</sup> of Ianuary, that day which you did batter *Sandhill*, and the skirt of the old Towne, afore mentioned, for all your often shooting, yet there was one halfe Canon lay upon it, not farre from your breach undismounted. The same page, after he had taken his Levell, gaue fire upon two horses and a waggon which came riding along the strand from *Albertus Sconce*, towards your *Pile Batterie*, it seemes laden with powder or Bullets, he made so dire & a shot, that he strooke his marke, killed one of your horses, and the Waggon shot a peeces. The Page being overjoyed with this shot, he would needes make an other, and whiles he was a levelling his peece at an other marke, one of your Canoniers turnes a peece aside from the *Pile Batterie*, and shootes iust in at the very *port-hole* of our halfe Canon, and came so right, that it licked off a pound or two of the mettle of the *Muzzle* upon the upper *Frizes* of our halfe Canon, some peeces of this mettle killed a Gentleman that stood by as a spectatour, and shot Sir *John Ogles Cooke* into his belly, which was there likewise, but the page which stood behind the brich, a levelling the peece with his thumbe, escaped, and had no harme, but your bullet flying by his eare made such a humming noise in his head, that hee thought there had bin a swarme of Bees in it. This I haue written, not for any Ostentation, but onely to shew you, how miraculously (yea even in the greatest dangers) God can preserve his servants, according to his promise: *Psal. 90. verse 7. A Thousand shall fall at thy side, and ten thousand at thy right hand, yet it shall not come nigh thee.*

One more, and then I will end my digression: At the last seige of the *Bossh* the yeere we took it in, Anno 1629. Wee having advanced our Approaches close under your little *Sconce*, a musketteir of ours, putting the nose of his musket through the Musket Baskets to giue fire, one of your *Firelockes*, lying upon the *snap* for him, gaue fire upon him iust at the very same instant, and shot his firelock bullet right into the very mouth or boore of his musket, so that the bullet striking against the scrue of his brich, burst open the *touch-hole* of his musket, and a peece of the bullet came out of the said *touch-hole*, while the Prince of Orange, Sir *Horace Vere*, Colonell Generall of the English, and diuerse other Officers stood by, and thus you see how wonderfully it pleased God sometimes to preserve his creature.

Now I come to you againe, where you exhort all *Master-Gunners*, and *Canoniers*, that will studie this Art, that they with great care and diligence practise these rules abouesaid, for the levelling, ayming, and taking their markes right, remembring, that there is more dexterity, and cunning to be showne in shooting at a ship, sayling away swiftly before the winde, then at a Troupe of Horse, or Men marching softly upon the Land, or to dismount a peece planted upon a Tower or a Bulwarke, where you haue an immoveable marke, especially when as you are to shoot upward.

This Art must be learned and practised, when you haue not much to doe, that when necessity calls for your employment, you may then not onely be able to doe your Prince and Countrey service against their Enemies, but also gaine your selfe fame and reputation.

Now hauing treated at large in the former Chapter, how you shall *levell* your peece *point blanck*, *levell with the mettle* or at a *range*; according to the elavation you giue it. To shut vp all, take this observation along with you, that if the *frizes* of the *muzzell* of your peece, or the button of it be higher then those of the *brich*, then it will carry ouer, Again, if you take your aime from the *brich* aboue the same, and the *button* resting onely vpon the thicknesse of the *Mettaline-substance*, your bullet will alwaies fall short. But if your *frizes*, be alike, aswell at the muzzle as at your brich, then you shall be sure to shoot levell with the mettell of your peece, & shall not faile to strike the marke you shoote at: if it lies within the termes of the pointes abouesaid.

HOW



HOW AND IN WHAT MANNER A GENERALL OF THE ORDNANCE ought to plant his Canon in a day of Battle, whereby he maye annoy most an Ennemy.

*Extracted out of the second treatise of Don Diego Vffano his fifth Dialogue betweene the Generall of the Ordnance, and a Captaine as followeth.*

**G**enerall, Sir, I would faine know of yow, how Ordnance ought to be placed in a day of battle, which might gaule an Ennemie most?

**Captaine.** I make noe question, but your Lordship having had experience in the warres of *Savoy*, & *Hungarie*, can tell better then I am able to speak, and if I should vse a tedious discourse, it might then seeme that the *Scholler* should presume to teach his *Master*.

**Gen.** Howsoever in such a case I would willingly take the advice of an old experienced Souldier, and especially of such a one, who hath served in these parts. As for mee, I dare not boast of any great experience, having had enough to doe to look vnto my owne affaires, neither have I had much leisure to informe my self well about *Artillerie*. But now seeing I am to receiue that charge vpon mee, I pray yow tell mee, as a man who hath bin beaten there vnto, & hath had longe experience in the warres, how they doe vse to plant Ordnance in these quarters.

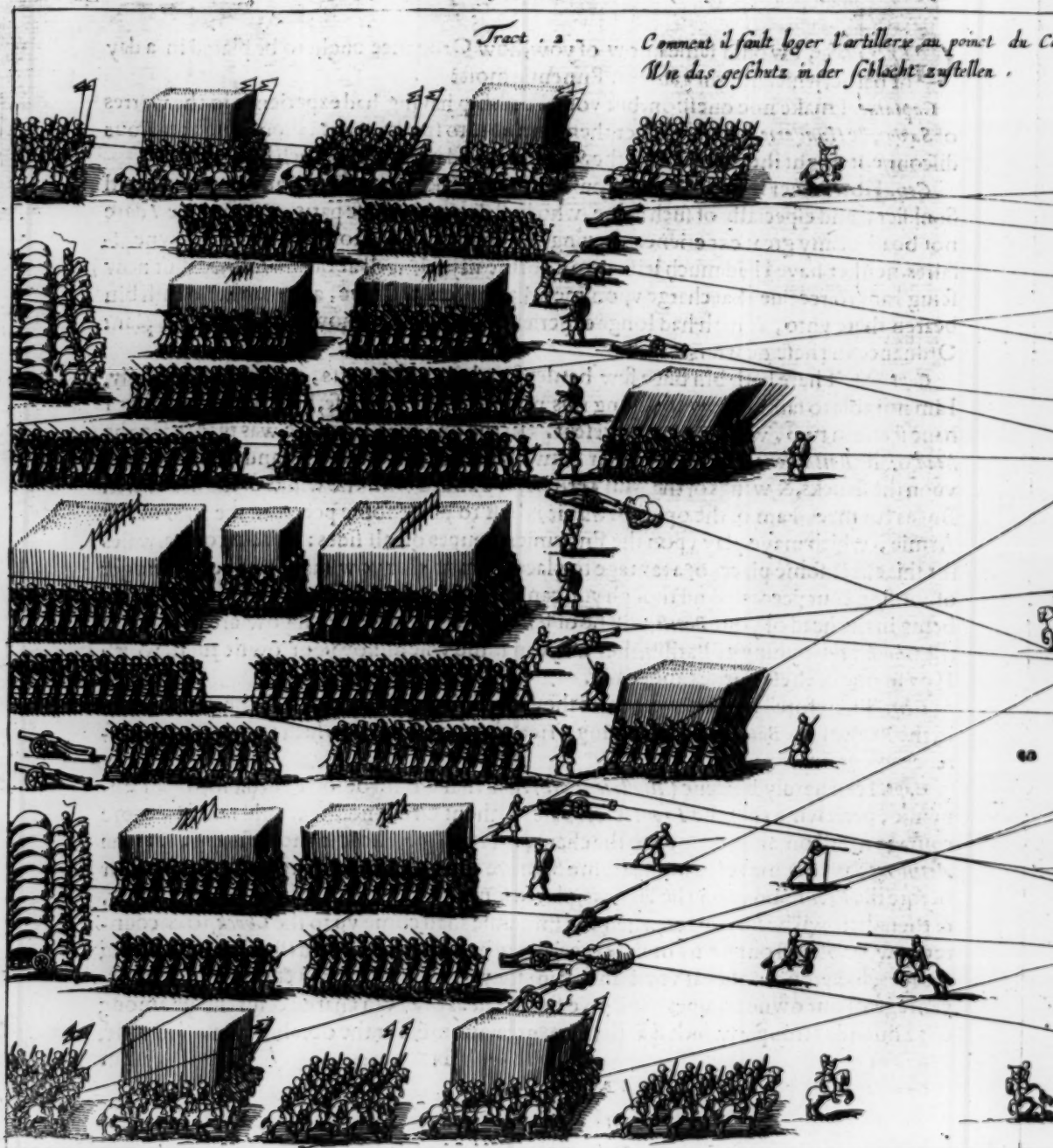
**Capt.** Sr, There hath bin but a few battles fought in these parts, and to speake truly, I am not able to satisfie yow touching this point. Nevertheless, I will tell yow what I haue scene in two, wherein I was present. In the one the Ordnance was planted in the head of the *Battaillons*, and in the other betweene them, two by two, and three by three vpon the flankes, & wings of the Muskettiers, & blinded with the wings of the *Cavallerie*. But as for mee, I am of the opinion that it is best to plant some peeces in the front of the Armie, which maye play vpon the Ennemies troupes on all sides: seeking out alwaies for this effect, some places of advantage to place them in, that yow maye not be in daunger of loosing your peeces. And though you cannot get such an advantage, yet your peeces being in the head of your *Battle*, will be of lesse service, because when yow are to come to the *Chock*, and joyning of Battles, they maye in some wise annoy your owne men, which I saw in one of these Battles abovesaid.

**Gen.** Therefore I think it were fitter they should be placed vpon both the *Flankes*, and in the *Reere* of the *Battaillons*, by leaving a free place of Armes, which maye giue noe offence to our owne men.

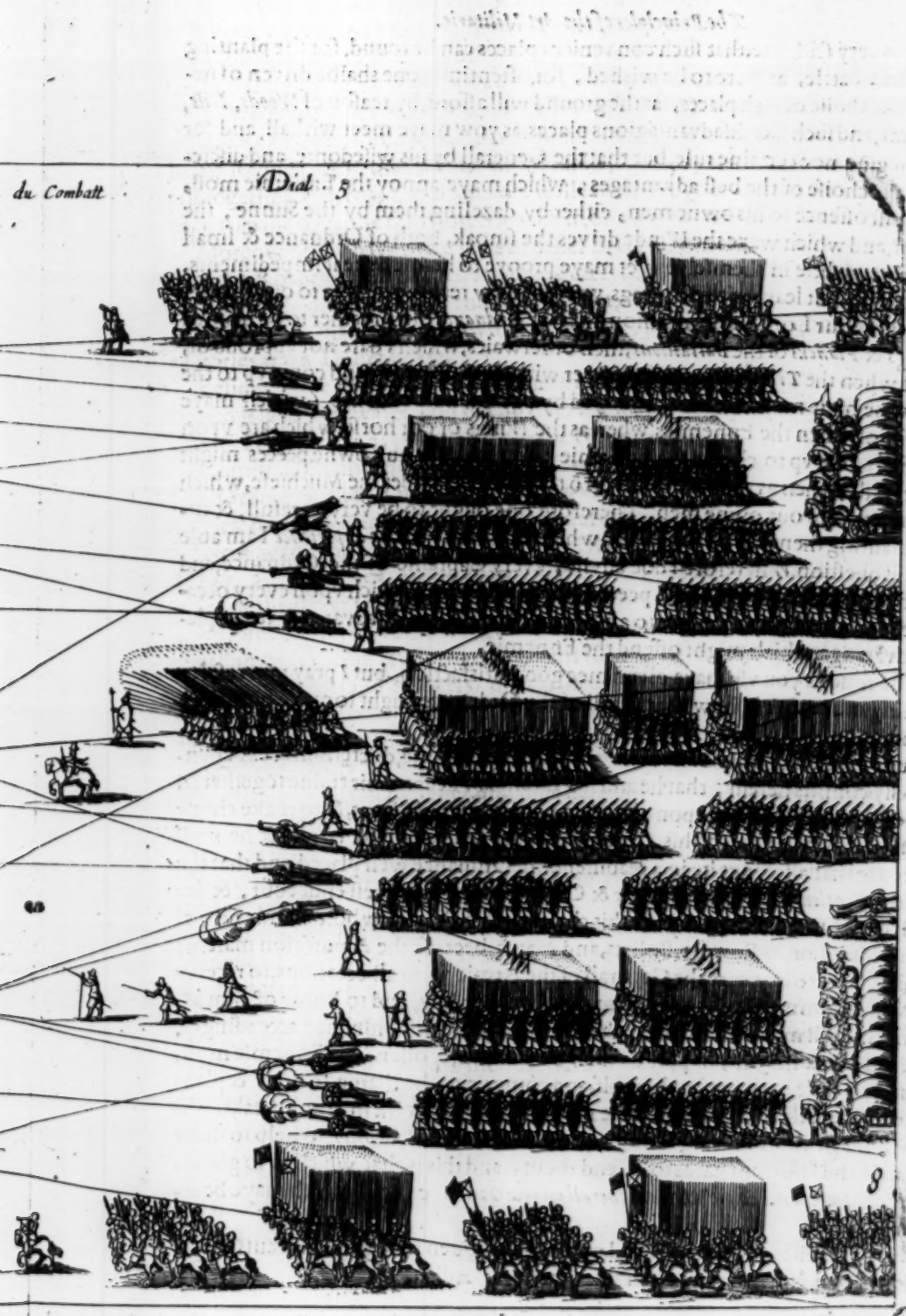
**Capt.** I can hardly beleuee (*Illustrions Sr.*) that that would be soo expedient, for an Ennemie, perceiving that the *Front* is left bare without Ordnance, he would take the more courage to fall on, and come vp to the charge: Therefore, I hold it more fitting, that the *Artillerie*, as yow maye see in the Figure S, maye be divided some here some there; both before the *Front*, and vpon the *Flankes*, placed some 50. or 100. paces one from an other, & then their will be no danger, when the Ennemie shall come vp to the *Chock*, to encounter yow, or offend our owne men, expecially when they are fastned to them by drawing Roapes, and yron rings, that vpon an instant they maye be remoued & turned for the advantage of our owne troupes, and give fire as fast as they can charge & discharge among the Ennemies troupes, which is a matter of great moment for the obtaining of a *Victorie*.

Tract . 2 .

Comment il faut lger l'artillerie au point du C.  
Wie das geschütz in der schlacht zu stellen .



du Combatt





But it happens very seldome, that such convenient places can be found, for the planting of Ordnance in a Battle, as were to be wished, for oftentimes one shalbe driven of necessity, to make choise of such places, as the ground will afford, by reason of *Woods, Hills, Marrish grounds*, and such like disadvantages places, as yow maye meet withall, and for which one can giue noe certaine rule, but that the Generall by his wisdom, and discretion, maye make choise of the best advantages, which maye annoy the Ennemie most, and give the least offence to his owne men, either by dazeling them by the Sunne, the arising of Dust, and which waye the Winde drives the smoak, both of Ordnance & small shott, which though litle in themselves, yet maye proove to his men great impediments, and disadvantages. But leaving these things, wee wil now returne againe to our former discourse, because your Lo: is of the opinion, that the *Ordnance* ought rather to be planted vpon the *Wings & Flanks* of the *Battailions*, then otherwaies, which I dare not approue of, in regard that when the *Troupes* are to encounter with the Ennemie, and come vp to the *Charge*, our owne men maye be more annoyed by our owne Ordnance (which maye breede a confusion) then the Ennemies, when as the *Wings* of our horse, which are vpon the *Flanks* shall come vp to charge the Ennemie: so that then our owne peeces might pusele them greatly, when as they are to play frō the *Flanks*, besides the Mischiefe, which might happen amonge our owne men. Therefore, one ought to be very carefull, & circumspect in planting them. And this is that, which out of my owne experience I am able to say vpon this question. Wherefore I doe advise, every Captaine of the Ordnance, and Master Gunners, to vse some light feild peeces, and small Drakes, which vpon every occasion maye be remoued from one place to another, and courageously advanced, to the places of most advantage, which might offend the Ennemie.

*Gen.* Sr, The reasons you vse, have given mee good satisfaction, but I pray you resolve me of one thing more, that is, how a Generall of the Ordnance ought to carrie himself in the day of Battle.

*Capt.* In such a time, the *Generall* is to show most his wisdom, discretion, & experience, which chiefly consists herein, that he and his *Lieutenants* keepe their traine together in good order, to have a vigilant eye vpon all accidents, that maye fall out, & to make choise of such ground, for the planting of his Ordnance, as the *Generall* of the Armie & he shall thinke best, to see that all things be in a readinesse, the Ordnance well placed, and that the *Master Gunners, Gentlemen* of the Ordnance & *Canoniers* doe their best endeavour, & acquit themselves like men. It is partly also his charge, to see, that the whole Armie be well provided with Munition, as Powder, Bullets, and Match, because the Amunition marches vnder his traine. He is to be neere the Generall of the Armie vpon all occasions, to receiue his directions, and Commands, & to see them executed speedely, and to know of him after what forme he will make his Battle, that he maye plant his Ordnance accordingly, & so to finde out hills & heighths, to play over his owne men, & offend the Ennemie most. And when an Ennemie shall present himself, and come vp to the charge, to draw & plant his Ordnance, as neere their horse as possible maye be, to hinder them from breaking in vpon the deuisions of foote takeing along with him *Saylours & Pionniers*, to help to draw vp the Ordnance and sufficient gards to defend them, and this is that, which in so great a buyfnesse is the charge, and dutie of the *Generall* of the Ordnance, and which maye be required of him.

*Gen. Captaine*, this discourse hath pleased me well, and giuen mee good contentment, and I am glad, that I mett with yow vpon this occasion, Adieu.

Treating of the diverse sorts of Bridges, used in the service of the Lords  
the States of the United Provinces.

**M**Any a brave occasion in the warres hath bin lost, for want of Bridges to passe over a River, a Brook, or a Moate: therefore the States for any peece of service, have alwaies diverse Bridges in a readinesse, both small & great. The smaller sort for any suddaine enterprise, or for putting over the Moate of a Towne, a *Hornwork*, or a *Halfe-Moone* are Three, as first a *Corki-Bridge* now not in vse, secondly, a *Bullrush-Bridge*, the peeces whereof are ten foote longe, and six or seven foote broad, that four men may goe over them in *Front* described vnto you in my second part in the Chapter of *Approaches*, Figure 159, whereof many peeces being ioyned fast together with roapes, and anckors, will laye a Bridge over a Moate, a Brook, or a Ditch for men to passe over, the third sort is a wicker, or a *Basket-Bridge*, as shalbe here after described.

Moreover, they have three sorts of other Bridges, namely, a small *Boate-Bridge* with Beames Plancks, Roapes, and Anckors, which are carryed vpon long Waggon in the Armie, whereof you maye see one of them in this treatise Chapter the 3. Figure 10. of these wee have commonly twelve, that goes along with our Armie vpon a long Waggon, drawne with 15. couple of horses and a Thiller horse.

Besides, those above mentioned, there are two great Bridges, the one called a *Punt-Bridge*, which is layd longwaies, end to end over the *Rhene*, or any other great River, and the other a *Maze Ship-Bridge*, as you shall see in the Figure following.

Command then being given to the Captaine of the Bridges and his men, for the first they lade Ordnance, and all manner of *Equipage* in those great *Punts*, as Beames, Plancks, Cordags, Cables, Anckors, *Windlasses*, *Winches*, and al other necessities, to bring the vp to the *Rendezvous*.

Now when the Captaine of the Bridge is to laye a great *Punt-Bridge* over the *Rhene*, or the *Whale*, as at *Nemegen*, *Schenckscance*, *Wesell*, or at *Rhene-bergh*, takeing first the breath, and distance of the River from the one side to the other, they can easely give a gesse, how many of these *Punts* being 50. foote long, and 10. foote broad, will serve to reach over the River. The first *Punt* then being layd longwaise from the edg of the one side of the River being fastned to two great *Stakes* (and *Anckers*) driven into the ground, they then lay at the furthest end of the first *Punt*, and other *Punt* laying Brush at both ends of the *Punts*, which rises and falls, that horse and waggons maye passe over them, and alwaies fasten and binde them together with Ropes, and Cables which stayes the *Punts*, by casting out Anckors and Cables into the streame, to hold them fast together, and thus they doe till they haue layd over 15, or 16 of these long *Punts*, which will reach over from the one to the other side of the River, at the ende whereof there are cast vp two *Halff-Moones*, (if it be not neere a Towne) and a *Steckado* or 2 *Gats* made, that none maye passe over it without leaue, having alwayes a gard to defend it and keepe it from burning.

Number 37. is the Figure of a peece of a *Basket-Bridge*, such a one as was vsed at our last Enterprise vpon *Hulst*, made of *Wicker* about de biggnesse of ones middle finger, with Supporters of wickers with in it, as hedges a foote distance one from an other, to strengthen it, and helpe it from bending, when one goes over it, being also matted in the bottome and covered round about with waxed Canvas being carried betweene two men, with two *Coole Staves* some 13 foote long, as two men carries a *Hand-barrow*, being layd *Crossewaies* peece to peece and fastned together with roapes, and at both ends Anckors. The length whereof from A. to B. is 6. foote, and the breath from C. to D. two foote and a half, and is a foote in heighth, so that two men in front maye goe over a Moate vpon any *Surprisall* of a Towne.

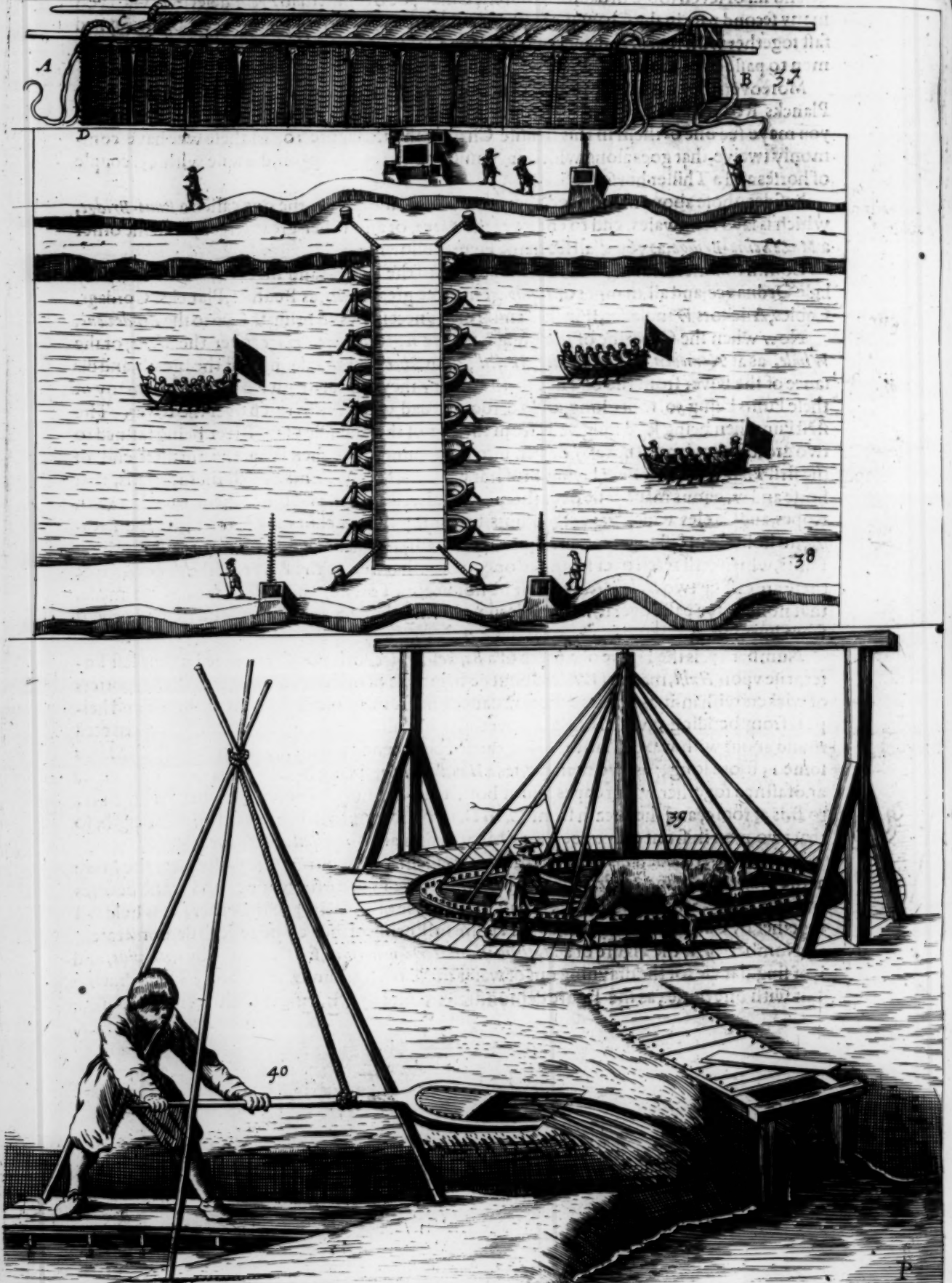
Number 38. is a *Maze-Bridge* layd crossewaies, such a one as our Armie passed over the Maze at the *Grave*, *Venlo*, and *Mastricht*, having beames some 15 or 16 foote long, and crosse beames over the Maze-Schips with Plancks from the one side of the River to the other, & is held fast together by Cables and Anckors, as the Figure following of such a Bridge doth demonstrate.

Number 39. is the Figure of a *Mathematicall Horse-watermill*, first invented by *Vitruvius*, and is of singular vse for the drayning out of water in Marrish grounds, and places, being drawne but with one horse, as the Figure demonstrates, and by relieving it with fresh horses and a Driver,



Driver, maye goe night and day: the experience whereof wee saw at the seige of the *Bosch*, what abundance of water twentie of them drayned out of the overflowne Meddowes & the River of the *Duymell*, which did helpe and further our Approaches greatly.

Number 40. is the Figure of a *Water-Scoupe*, made after this manner following, first you take three long *Poles*, or *Sparrs*, and at the topp binde them together with a match or a Cord, frō the topp whereof discends an other Cord, which is bound fast to the haffi of the *Scoupe*, as you maye see, and the feete of the *Sparrs*, putt into the ground *Triangular* wise, with which yow see the Figure of a man casting water out of a *Moate* or a ditch. This Plate P. following will shew the Figures of al that is said aboue.





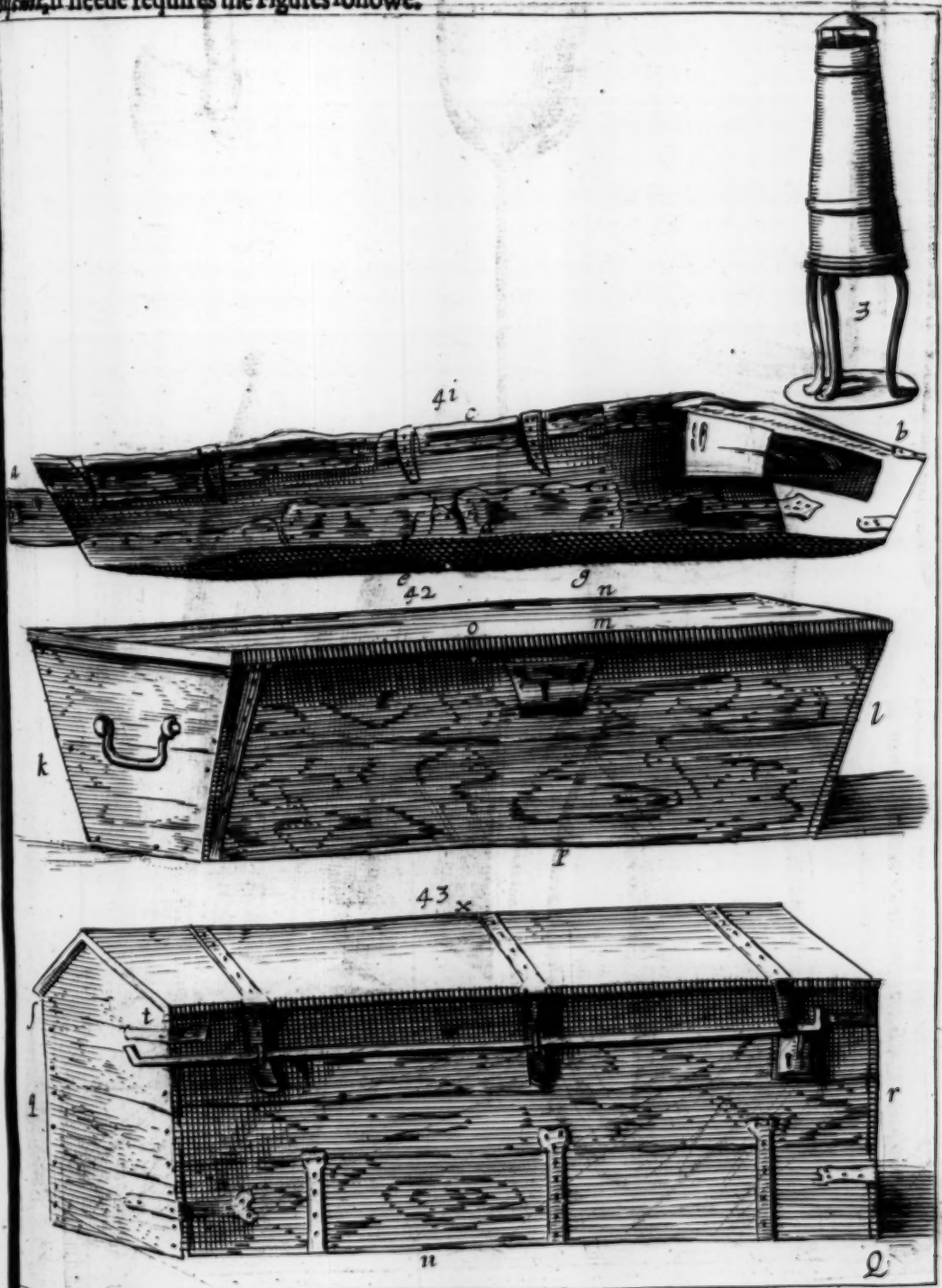
*Practised in the warres of the United Nether-lands.*

# THE DEMONSTRATION OF A COPPER-OVEN, A KNEADING TROUGH and a Bread-Chest with the appurtenances there vnto belonging.

Number 41. is the Figure of a new invented *Copper-Oven*, sett vpon three yron *Chimnies* for the bakeing of bread for an *Armie*, having at both ends two mouths or doores, which opes and shutts, whereof the length of one of them from A. to B. is nine foote longe, the bredth from C. to D. is three foote, the heigth from E. to F. to the topp is a foote & a halfe, & the bottome vpon which the bread bakes marked G. H. is two foote & a halfe. This *Oven* (as is said) stands vpon three yron *Chimnies*, noted 1. into which fuel and Turf is putt to heate this *Oune*, how many *Loafes*, & pounds of bread it will bake in three hours, the list following will show yow.

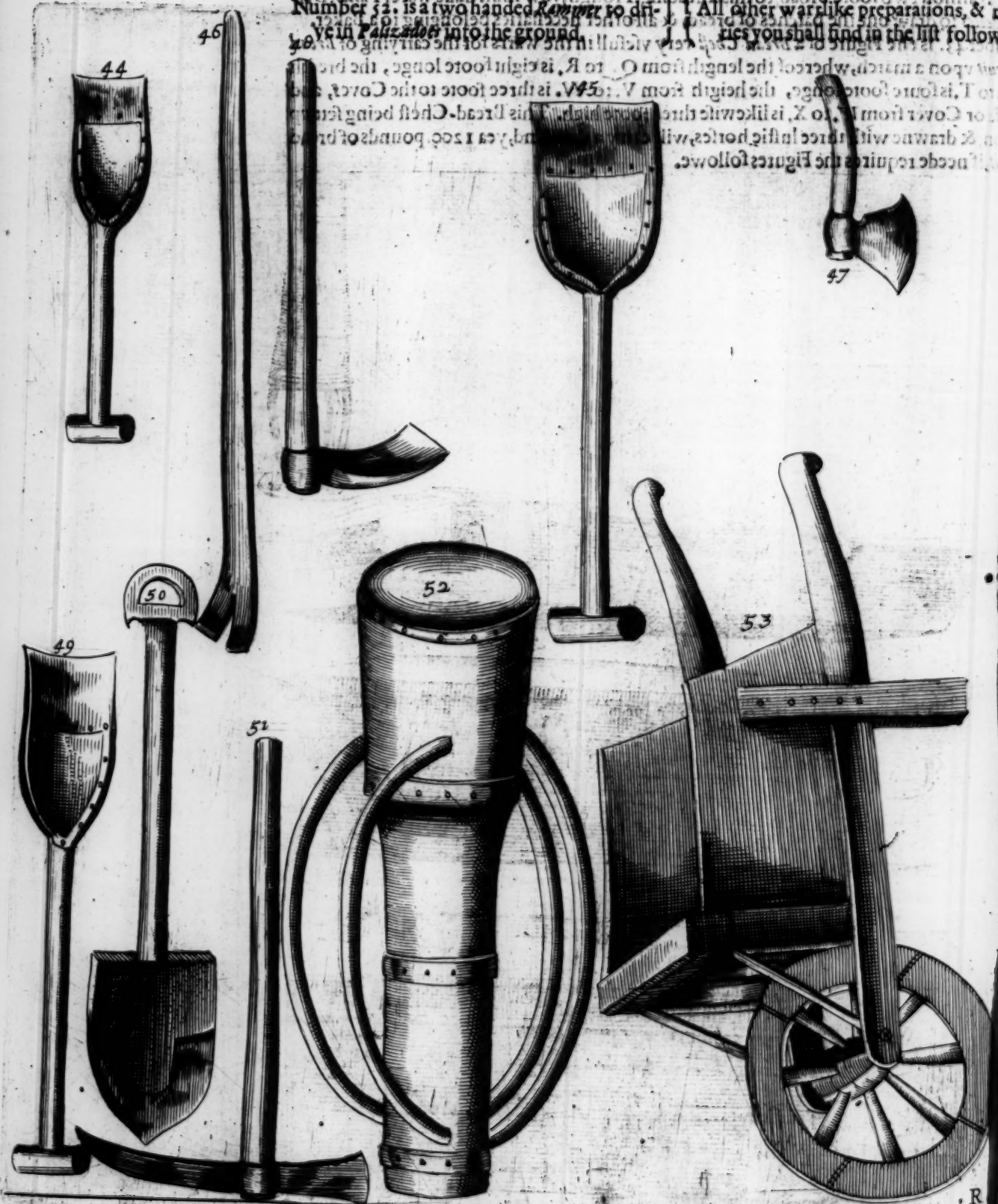
Number 42. is the Figure of a *Kneading Trough*, which from K. to L. is seven foote longe, and from M. to N. is two foote broad, the Ledge or cover O. is three foote high, and the bottome P. is almost two foote broad, to this kneading Trough, yow must haue water *Pailles*, *Dowls*, *Peeles* to draw out the batches of bread, & all other necessaries belonging to a Baker.

Number 43. is the Figure of a *Bread-Chest* very vsfull in the warres for the carrying of *Bread* and *Biscuits* vpon a march, whereof the length from Q. to R. is eight foote longe, the bredth from S. to T. is foure foote longe, the heigth from V. to W. is three foote to the Cover, and the rooffe or Cover from W. to X. is likewise three foote high. This *Bread-Chest* being sett vpon a *Peggon*, & drawne with three lustie horses, will carry a thousand, yea 1200. pounds of bread *Biscuits*, if neede requires the Figures followe.



THE DEMONSTRATION OF MATERIALS, USED IN OUR WARRES  
the making of Trenches, Approches, Saps, & workes of Fortification as followeth.

Number 44. is a short *Plated Shovel* to worke in a Sapp or in a Gallerie.  
Number 45. is a long *Plated Shovel*.  
Number 46. is an *Iron Crow*, or a *Goatsfoot*.  
Number 47. is a *Hatchett* to cut wood with.  
Number 48. is a *Massack*.  
Number 49. is a *Spade* with plated yron.  
Number 50. is a *Sadd Spiller*.  
Number 51. is a *Pickaxe*.  
Number 52. is a two handed *Hammer* to drive in *Palisades* into the ground.  
Number 53. is a *Wheele Barrow* to carrie Earth & Sodds in for the making vp of works.  
Palisadoes of two sorts you shall finde in my second part in the Chapter of approches Figure 166.  
And *Frize-Buyters* or *Turne Pikes* in the same Chapter Figure 165. And foote and on *foote lanterns* in the same Chapter Figure 147.  
All other warlike preparations, & necessaries you shall finde in the list following.





The Office.

And charge of the Generall, or Master of the Ordnance,  
and all other Officers subordinate vnder his Traine of Artillerie Munition,  
and victuals, as the particular lists of all preparations, and necessaries belonging  
to an Armie shall be here demonstrated.

**T**HE Generall or Master of the Artillerie (as is  
showne in my second part of the chiefe officers of the feild pag. 9.) is a very honorable charge  
and hath command and super intendencie ouer all the ordnance, Armes, Munitions, Engines, Materials  
& Instruments for worke, yea, of all things belonging to the Ordnance, and hath also absolute Com-  
mand ouer all Inferiour officers appertaining to the Traine of the Ordnance, as ouer the Lieutenant of  
the Ordnance, The Controulr, The Clarke of the Ammunition, and Materials, The Gentlemen of the Ord-  
nance, and Master Gunners, Canoniers, Armourers, Ingeniers, The Captaines of the Pioniers, and Mineurs,  
ouer all Smiths, Carpenters, and wheelwrights, ouer all Artificers, and Handie-crafts-men, and all such  
as doe attend vpon the traine of the Artillerie, Munition, and Materials. And when the Armie is to goe  
into the feild, he sends his warrants and patents out to all officers vnder his Charge, to meeete him at the  
Rendezvous.

Now for the better helpe, and discharging of his office, he hath a Lieutenant of the Ordnance allowed  
him, who in his absence hath absolute command also ouer this Traine, and is giuen him as an assistant,  
to helpe him in the execution of his Commands.

And because the Generall, or Master of the Ordnance, is commaunded in his Commission, and parti-  
cular Instruction, to keepe a perfect account of all great, and small peeces of ordnance, equipages, Muni-  
tions, Materials &c. he hath allowed him a Controulr of the ordnance, which Controulr is obliged, and  
bound to keepe a pertinent list of all the peeces of ordnance great & small in the *Arsenals*, and *Magazines*,  
belonging to the Land, registring the weight of them, the Armes, and other things, that stand vpon them,  
as likewise what weight euery bullet is, which euery peece of ordnance doth shoote, who cast them, how  
they came to belong vnto the Land, moreouer, to keepe notice of all Carriages, wheelies, plated, or vnpa-  
ted, yea off all things else belonging to the traine of the Artillerie, as maye appeare more at large in his In-  
struction.

Unto this Traine of the ordnance there are allowed two *Commisles*, or *Clarks*, one for all things apper-  
taining to the ordnance, The other ouer the Munition, Armes, Materials, Toolies, and ouer all other ne-  
cessaries, belonging to the Armie, as shall appeare in the list following.

The Council of State, having resolved for the feild, they send for the Controulr of the ordnance, and  
giues him a list of all necessaries belonging to the Canon, where of the Controulr deliueres a coppie of yr  
to the Clarke of the ordnance, who receiues charge to take on certaine Conductours to the number of  
some 40, that by their helpe and care, all things containd in the list, maye be in good order taken out of  
the *Arsenals* and *Magazines* of the Land, and to see them well embarked, or put vpon wagons to be  
brought with all expedition to the Rendezvous appointed, and because the ordnance, munitions, and Materi-  
als maye be taken out of severall *Townes* and *Magazines*, he giues to euery Conductour his charge in writing,  
to lade such and such ordnance, Munition, & Materials, in those places as he is appointed which they are  
to shipp, and bring them vp to the place designed, as they will answere to the contrarie, if any thing should  
be lost.

A List, or Supposition.

What Ordnance, Munition, materials, and other

necessaries, are usefull to be carried into the feild with  
an Armie, as followeth.

**Imprimis for batteries** 6 whole Canons  
reinforced, & 14 demy Canons reinforced, 6 long fill  
Carrying a bullet of 12 lb. weight, & 14 demy  
Canon Drakes, of 12 lb. bullet, & 14 quarter Canon  
Drakes of 12 lb. bullet, & 14 short Drakes, or Sakers of 8

lb. bullet, & 14 small Drakes of 3 lb. bullet making  
in all  
For 6 whole Canon spare Carriages, & for the 14 demy  
Canons reinforced, for the 6 feild peeces, & for 14 demy  
Canon Drakes 8 for the quarter Canon Drakes, & for



# The principles of the Art Militarie,

the Faulconets, and saker drakes 12. facit in all	29.	Strycking ropes	8.
Spare Ship Carriages for these severall peeces of Ordnance	20.	Drawing lines	70.
Spare Wheels proportionally for the Ordnance about speeci- ficd of all sorts.	20.	Neck links to make up shipping, or use full about ord- nance	40.
Fore-Waggons, or Carriages	80.	Ramming blocks to drive in piles, in the ground	12.
Spare Wheels for the fore carriages	12.	Small Rammers to drive in piles	10.
Block waggons & long Waggons to lay, ordnance on,	25.	Spare ropes	12.
Spare fore and after Wheels	12.	Great Iron hammers	7.
Spare Thillers for the Block Waggon	3.	Beames, and underlayers for plat-formes, and other uses.	10. foor long
Spare long Waggons for the Block Waggons	3.	Plankes for bedding & other uses	400.
Spare axeltrees, and draughts	3.	Sparres	600.
Sledges, to draw ordnance on	8.	Spades	1000.
Fearnies, or Windlases compleat	8.	Shovells	2000.
Eschelets, or martinetts.	6.	Asises	500.
Iron Crowes, or Goat's feete, handspikes, and levers of all sorts.	20.	Hatchets	500.
Brasse pullies, or truckles	20.	Hand bills	500.
Winches, or the Endless screwes	12.	Pick axes	300.
Iron bolts.	10.	Mattocks	300.
Spare karnis of Salett oyle, for the Engines abovesaid	6.	Iron hammers for the Greater of ordnance	12.
Tart, or grease boxes,	25.	Lanternes	30 lb.
Spare boggs-grease for the carriages.	1300.	Candles	300.
For every pece of these Ordnance abovesaid, three ladders,		Frie lights to putt in pitch ropes	20.
Three Rammers, and 3 sponges a pece facit	140.	Leather pails to quench fire with all	30.
Sponge Copper mallets	1100.	Canvas peeces, to make blinds with	30.
Sheepe skinner, to make sponges of	400.	Pack thread	20.
Wooden levers for the Ordnance	50.	Saile yarne	4 lb.
Iron Crowes	20.	Firkins of round pitch ropes	12.
For 6 whole Cannon bullets of 48 lb.	1000.	Bolts, and clenchers for the Axeltrees of Carriages and the Block waggons	60.
For 12 demy Cannon bullets of 24 lb.	5000.	Bolts for the Thiller carriages	60.
For 6 field peeces, or demy culverins of 12 lb.	1500.	Bolts and clenchers for the long Waggons	60.
For 16 Faulconets of 6 lb. bullet	1000.	After hookes for the carriages	10.
For the Demy Canon drakes of 12 lb.	1500.	After Nails	50.
For the quarter Canon drakes of 12 lb.	1500.	Spare clenchers and wedges for the ordnance	40.
For the Sakers of 6 lb. bullet	1100.	Wedges for the black and long Waggons	160.
For the small drakes of 3 lb. bullet	2200.	Small sheires, with bolts and rings	100.
The Gavrons, and Cannon ball kers, are made in the Feild, some 6, or 6 1/2 foor high, and 3 foor in diameter, and costs 18 sh. a pece Latten, Boxes for the cartredges shoot for every pece 100. facit in all	4000	Shires with chains	30.
Powder for these 50. peeces of ordnance	400000 lb.	Nails for the bolts	150.
Match in Bundles	300000.	Great iron Nails	150.
Pouch-Barrells for the charging of ordnance with each a Wooden hammer, and his dish	80.	Iron Staples	100.
Haire-cloaths	100.	Latten Boxes with cartredges	1000.
Murdles to plant ordnance on which are stiff	500.	Type of diverse sorts	100 lb.
Hand Barrowes	50.	Bundles of ropes and Cordage	10.
Musket Baskets of all sorts.	1100.	Nails 8 ynces long	1600.
Wooden blocks	20.	Nails 7 ynces long	1000.
Thiller Harnase compleate	150.	Nails 6 ynces long	6000.
Spare ropes & bedd harnase	150.	Nails 5 ynces long	11000.
Plated crosse staves for the drawing ropes after every couple of horses	189.	Double sized nails	20000.
Whip cord to binde with all	1000 paire.	Single sized nails	20000.
Horse collars.	800.	Small nails, and lath nails of all sorts	20000.
Drawing ropes of 40 sadome a pece	80.	Bundles of lath work	400 lb.
Half drawing ropes	80.	Plate iron, and small barres for smiths	3000 lb.
Striding ropes	80.	Of stave steelt	1000 lb.
Windlass Ropes	8.	Item all smiths Tooles, and vintles.	
		All Carpenter Tooles, as want to be need full in	
		And great Morters, mounted upon their Cartwheels.	
		One small Morter for each 100. grenades of 20 lb. for mortar great, and 100. grenades of 20 lb. for the lesser.	
		Hand-grenades to cast into ships, trenches, and works.	

*Practised in the warres of the United Provinces.*

A list of some other  
Materials, and necessaires, which the Clarke of the  
Materials vses to carrie with him to the Feild, to make  
a Magazine of in the Army as followeth.

<b>P</b> owder for Muskettiers	500000 lb.	Driggs	29.
Match in Bundles	80000.	Nails both greate and small enento lath nails of all sorts	100000.
SoW-lead to cast muskett bullets With	50000.	Lanterns and blinde lanterns of all sorts	40.
Moulds of 12 bullets a peece to cast in	50.	Candles	400 lb.
Haire-cloaths to cover the powder With	60.	Torches	50.
A Great many of old peeces of sailes to make blinds With	1000.	Fire-lights 25 and pitch ropes	600 peece.
Spare Musketts	500.	Barrils of pitch	6.
Spare Musket rests	1000.	Barrils of Tarre	4.
Spare Bandeliers	500.	Woll-sacks	100.
Spare muskett stockes	300.	Howerglasses	50.
Pikes 16 foote long besides the head	2000.	Untempered chaull in barrils	a last.
Half-Pikes With Loop staus-feece	300.	Ship-Katroles of all sorts	110 single.
Corlets, and Head peece	300.	Double Ship Katroles	70.
Armors of prooffe With Casckes of prooffe	100.	Drawing lines to draw Shipping against the streame	60.
Lavelines double pointed, With yron to putt through the trees of Turnepikes	1500.	Bags to fill earth Withall upon an Approah	1000.
Match-Hornes to blinde light matches upon an enter-prize	3000.	Ammunition chests to put them in	6.
Running Draggons With two wheeles, and Laveline putt through the Axeltree	300.	Blinds of Kanvas 150 foote long each peece	100.
Short Palissadoes to drive into the ground With long tanter nails	6000.	Plancks, Sparris, beames of all sort good store for ordnance, palisadoes, galleries, and other Workes, some shorter, and some longer as occasion maye serve.	
Yron hammers to strick the nails in	50.	Great block pile-drivers, With all their ropes, and appurtenances	1.
Wodden hammers to break open the barrils of powder	200.	Two-banded Rammers for two men to drive in palissadoes With	20.
Great Boorers to boore holes With	9.	50 peecees of bulrush bridges, coudered over With Kanvas, With their ropes, & coards to fasten them one to an other and ankors each peecees being 10 foote long, & 6 foote broad, Corke bridges each bridge containing 10 peecees ioyned to gether, & each 10 foote-long	1.
Twelve firkins of foote angles, or foure square tanter nails	11000.	Cordage of all sorts	400 lb.
Yee sparris With lachets	6000.	Windlasses or Winches	2.
Peecees of Bulrush bridges for an Enterprize to passe over a moate, or ditch	150 peecees.	Leather pailles to quench fire With	300.
Hand-barrowes to carry fodd With	150.	Hand sawes, two banded sawes, and great timber sawes	150.
Shippers hookes short and long	150.	Augers of all sorts, Dimbles, & Adasies	50.
Long yron rakes With 3 or foure teeth	150.	Good store of Carpenters tooles.	
Great Beetler	100.	All things necessarie for 100 Karres, to carry earth in compleate wheele Barrowes	1000.
Water scupps	200.	Spare wheeles and yron pinns for them	500.
Mathematicall Water horse miles, to drawe out Water, se figure 37	3.	Single sawne plancks for the wheele barrowes	200.
Spiters to spit fodd With all	300.	Quarter staves, or great Beacons to lay out the quarters with all With flages	100.
Bagger Netts to worke in a gallery	15.	Hussels, and Turne pikes, With their Lavelins small and great	100.
Crooked yron Shovels, with long basis to worke in a Gallery	12.	By this List abovesaid, one maye easely understand, What Munition, Materials, and necessaries are needfull to be carryed into an Armie, of all Which the Clarke of the Ammunition, and the Materials shall deliver them out by the helpe of their Conductors, as the occasion of the maye service require, and also receive them into their Custodie againe.	
Spades	10000.		
Shovells plated	2000.		
Mattocks	1000.		
Pick axes	600.		
Great yron hammers to break stone Walles With	100.		
Axes of all sorts	1200.		
Hatchets and hand bills	100.		
Great Pinners	8.		
Great and small hammers	28.		
Yron crowes of all sorts	30.		

The



## Waggon Master Generall, his Lieutenant, and Conductours march vnder the Train of the Ordnance.

**B**Efore the Armie rises to the Feild, the Lord Generall sends out writs for the Waggon Master Generall, that he shall send for his Conductours, to presse and take, vp soe many waggons, as the greatnesse, or lideness of the army maye require, it maye be in every quarter 6, 7, 8. yea, 1000. waggons, and each waggon to be furnished with thre lusty horses, and a dryver, every waggon having 3. gildets a day, so long as the Armie is in the Feild, and the Conductours 30. stivers per diem.

### A List of the Waggons to be employed as followed.

**F**irst for the Generall of the ordnance his traine 150.  
 For the Lord Generall him self, as many as his traine shall require.  
 For princes Earles, and Lords voluntiers as many as they shall have use for.  
 For the Lords the Deputed States for the Armie as many as they have use for.  
 For the Clarke of the Munition, and his traine Including also the Controulers, Ingeniars, and Conductours two compaines of Pyoniers, and the Carpenters 120.  
 For the Sariant Majour Generall of the armie 2.  
 For the Commisse or Clark of the Victuals and his traine 320.  
 For the quarter-master generall of the foote 2.  
 For the provost marshall Generall 3.  
 For the three principall Chirurgians of the army 3.  
 For the Treasurer of the armie 3.  
 For the Waggon-Master Generall his Lieutenant, Conductours, Wheele-makers, Smiths, & Tow-workes 7.  
 For the quarter-Master of the Horse 1.  
 For the Lieutenant Generall of the Horse 6.  
 For every Colonell of the foote some 3. some 4. according to the greatnesse of their traine, A Lieutenant Colonell 1.  
 For every Sariant Majour 1.  
 For every quarter-Master of the foote 1.  
 For the Preacher of a Regiment 1.  
 For the Chirurgian & Provost of a foote Regiment 1.  
 For every foote Companie in the Armie 1.  
 The Bridgmaster hath under his charge all sorts of punt bridges & small boate bridges: the ordnance and all things else carried vp to the Rendevons in punts.  
 The Commisse Generall or Clarke of the shipping When the Armie is to goe into feild is to send forth two Conductours to presse so many Ships in every Towne and quarter, as the Generall shall give him order for, and as the greatnesse of the Armie maye require.

### A List of the Baggage Shippes, and for all Officers that followes the Army.

**F**or every Colonell and the chiefe Officers of his Regiment Ships 3.  
 For every three troupes of horffe 3.  
 For the Lord Generall and his traine 21.  
 For the Lord Marshall 5.  
 For forrain Lords and Earles 18.  
 The Quarter-master & the Provost goe in the Ship appointed for the Officers of the feild  
 For each Captaine of the Pyoniers a Ship 3.  
 For the Treasurer of the Army 1.  
 For the Advocate Fisall & his Recorder 1.  
 For the chiefe Master Gunner 1.  
 For the Captaines of the carpenters 2.  
 For the Provost Marshall Generall 1.  
 For the Generall of the ordnance 3.  
 For the Clarke of the Ammunition 1.  
 For the Clark of the Ordnance 1.  
 For the Clarke of the Victuals 1.  
 The Waggon-Master Generall 3.  
 The Captaine of the Canon Horfes 1.  
 The Commisse or Clark of the Shipping 2.  
 The Sariant Majour Generall of the Army 1.  
 The Quarter-Master Generall 1.  
 The Controulers of the Artillerie & Munition 1.  
 The Controulers of the Fortifications 1.  
 The Ingeniars, and their Assistants 1.  
 The Provost Marshall over the Shippers, and saylours 1.  
 Ships allowed for the transporting of sick and wounded soldiers 10.  
 Spare Ships for forraine Lords and Voluntiers 10.  
 For the Provost Marshall Generall of the Cavallerie 1.  
 For the Physician and Apothecary of the Armie 1.  
 Besides all these every Companie so long as they lye a Ship board have three, foure, or five Ships coming out of garrison till they march a land, Where of some of these Ships have three gilders, some a rixce dalder, others two gilders a day, according to their burden.  
 The Commisse or Clark Generall over the Victuals, hath superintendence and care over all manner of Victuals, as also victuallers and Suttlers, which followes the Armie, and hath under his charge diverse Conductours, and Bakers as the service maye require.  
 First if it be a long expedition, so that woe bread, or Victuals can come vp to the Army from the Shipping by convey, or



to any towne besieged it wilbe needfull for him to have  
meale barriled w<sup>th</sup> 156 lb. in a barrill 3000 barrills  
Which 3000. Barrills will require 600 Waggon.  
For the keeping of it in Shipping before it be loaded on  
Waggon he must have 5. Conductours, and Ships 9.  
All necessaries must he have also be longing to Bakers, and  
Bakers 72.  
As also 40. Kopper Ovens such as you see figure 47. each  
oven carried vpon a waggon, Troughs, dowe knifs, pails, &  
For these 40. Kopper Ovens sixe great kitchen tents, with  
two or three chimnies in them.

Now one Oven being 9 foote longe, and  $2\frac{1}{2}$  in breath, will  
bake in three howers a batch of 50. long loaves of bread,  
each loafe a foote long, & 5. ynches bread, which bakes  
at a time, 300 lb. of bread, and one Oven will bake in  
24. howers 300. loaves of bread, which makes 1800 lb.  
And 40. of these ovens being well beated, will bake 6.  
times in 24. howers, 12000. loaves, which at 4 lb.  
each loafe, comes for one day to 48000 lb. and for  
two dayes if the Armie rests 96000 lb. a reasonable  
proportion of bread 960000 lb.  
Item chiefe for the Army in store 500000 lb.

## The Demonstration for the Quartering of the Generall, or Master of the Ordnance, and all Subordinate Officers marching vnder the Traine of the Artillerie.

**F**irst this Quarter is in breadth, or Front from A. to B. 600. foote, and from B. to  
C. is 300. foote in Depth, which never take v<sup>y</sup> any more ground in Depth, but onely the Ordinary measure, for  
all the streets in y<sup>e</sup> are but 20. foote broad, and are marked D. E. & is the Parke or empalement of the Generall  
of the Ordnance his ground, with his Attendants, men, and Horses, as you maye evidently see in the raised Figure:  
Num. 1 is here a Parke or a square of 100. foote: In which parke his Tents, and Measures are sett v<sup>y</sup> as the first is  
as followeth, a Hall or place of 12. foote in square, and a Gallerie beyond that, and the great Hall of 6 foote long, and  
6 foote broad. The great Hall or dining roome is 24 foote broad, and 12 foote deepe. The two Pavillions are 12  
foote square. The Gallerie reaching from the one Pavillion to the other is 20 foote long, and 6 foote broad. The  
Gallerie from the great Hall to the gallerie of the two Pavillions is 10 foote long, and 6 foote broad. The Curtaines  
of the Tents are all of them sixe foote deepe, and the two first pavillions are likewise 12 foote square, and the Kitchen  
is 24 foote long, and 12 foote broad.

F. is the parke, or quarter of the Lieutenant Generall of the Artillerie, and for the Master Gnnners, and Gentle-  
lemen of the Ordnance, their servants, & Horses, which parke is 100 foote broad, and 40 foote in depth. The Tents  
of the Lieut. Generall, are of this Measure following. The great Hall is 16 foote in depth, &c. 10 foote broad. The  
Gallerie 6 foote long, & 6 foote broad. The Pavillions are 8 foote in square.

G. is the parke for the Materials of Amunition, as spades, shovelles, Hatchets, Billes. Axes, Pickaxes, Mattocks,  
planckes, beddings for Ordnances, beames, wheele barrowes, and diverse other things. This parke is 140 foote in depth  
& 130 foote broad.

Number 5. is the Hutt, or a Tent for the Clarke of the Materials.

Number 6. is a Hutt, into which all things are layd, which must not take wett. As Match, candles, and other  
things.

Number 7. is a Common Kitchen for all the Conductours, to dresse their Victuals in, & made there to keepe the  
quarter from frying.

Number 8. are the Conductours Hutt, some 8, or 10. foote in square.

H. Is the parke into which are layd, all the materials, instruments, & tooles belonging to the Ordnance, as also an-  
kers, powder, and bullets & diverse other things, which parke is 140 foote in depth, and 130 foote in breadth.

Number 1. is the tent, or butt of the Clark of the Ordnance.

Number 2. is a butt with all manner of Amunition, belonging to the Ordnance, which ought not to receive wett.

Number 3. is the Common Kitchen.

Number 4. is a Cave, or Sellar to laye in Gun-powder.

Number 8. are Hutt for the Conductours of the Traine.

I. Is the park or quarter for the Master Gunners, or Gentlemen of the Ordnance the ordinarie Gunners, & Canoniers,  
whose depth is 70 foote, & 40 foote broad.

K. Is the Parke or lodging of the Master of the fire Workes, with his Conductours, & men, whose parke likewise is  
70 foote in depth, & 40 foote in breath.

L. is the parke, or quarter of the Petardiers, and their men, which is also 70 foote in depth, & 40 foote in breath.

Q

M. is

M. is the parke of the Master of the Batteries, & his men of the same greatnesse.

N. are three tents, or butts for the Captaines of the Saylours, & marriners to attend upon the Ordnance, the Atti-  
cals, & drawing harnesses for the Ordnance and for the Mineurs.

O. are all butts 8 foote in square, each for two Saylours, and two Mineurs, The freetes also betwene every row of  
butts is 8 foote broad.

Their quarter is 140 foote in depth & 90 foote in breath.

P. is the parke, or quarter of the Clarke of the Fortifications, and his Conductours, being 60 foote in square.

Q. is the parke and quarter of the Inginiers, & their Conductours, being 80 foote in depth, and 60 foote in breath.

R. is the quarter-master of this traine his quarter, or lodging being 60 foote in square.

S. is the parke or quarter of the Captaine of the Canon, or drawing Horses, and his Conductours, being also 80  
foote in depth, and 60 foote in breath.

T. is the quarter, or parke for the makers of Gabions, or Canon bus kettis, & Musket baskets, being 40 foote in breadth  
& 60 foote in depth.

V. is the Armourers parke, and the quarter for the Generall of the Ordnance, with their Workemen, Farriers, and Smiths,  
belonging to this Traine, being 60 foote in depth, and 30 foote in breadth.

W. is the Chiurgians parke of this Traine, 60 foote in depth, and 20 foote broad.

X. is the Provost Marshall of this Traine, 60 foote in depth, & 30 foote broad.

Y. is the Farriers, or Master Smith his parke 80 foote in depth, & 25 foote in breadth.

Z. is the Carters or Waggon mens and labourers, 80 foote deepe, and 35 foote broad.

aa is the Coopers parke 30 foote in depth, & 25 foote in breath.

bb is three Huts or Tents for the three Captaines of the Pionniers, aa are the Huts of the Pionniers with their  
Lieutenants, whose butts, are in the front of the rows, and each Hut is 8 foote in square, whose parke is 90 foote in  
breath, & 140 foote in depth.

cc, is the parke, where in is sett the carriages of Waggon, and drawing Horses for the Ordnance, which is to be under-  
stood such as are to passe upon the Watch, and Canon for any suddaine peece of service, and to thend, the horses maye not be  
then to seeke. The two Huts with in the parke marked 9 are for the Conductours & Waggon Men. This parke is 140  
foote in depth, & 80 foote in breath.

The Geometricall modell of a quarter for the Artillerie followes.

And the Orthographie in perspective of the modell for the traine of the Ordnance.

You maye see here lively demonstrated in the which & Figure thereof following.

Finis Coronat Opus.

